ELECTRONICS Australia

HIFI NEWS

JANUARY 1974
AUST 60c* NZ 75c

WHICH PICKUP CARTRIDGE FOR QUADRAPHONIC?

RADAR IN SEARCH FOR MINERALS

144MHZ PA AMP FOR AMATEURS

MINI-AMPLIFIER FOR STEREO PHONES

Registered for posting as a periodical — Category B

SONY SOUND SEDUCES SCIENTIST...

The man in the white coat is a sound specialist. And he has just been captured by Sony. He's puzzling how such quality sound can come from such a compact, low-priced system. It's Sony's newest combination — the feature-packed Sony integrated amplifier model TA-1066. It has direct coupled differential power amplifier, a balanced positive and negative power supplied equalizer amplifier, and true complimentary circuits. Styling is the latest, with push button controls. Inputs and outputs for 2 tape decks permit dubbing between the deck and simultaneous recording. Slide volume balance has centre click adjustment. Frequency response is 10 Hz-40kHz and it cruises at 15W RMS per channel.

It teams with the new Sony TC-129 cassette tape deck with long-lasting Ferrite & Ferrite heads and capacity to play C_2O_2 tapes as well as standard. Auto stop, naturally. And a handy hinged dust cover lid. Frequency response with ordinary tapes 40Hz-12kHz and with C_2O_2 40Hz-14kHz.

Speakers are 2 Sony SS-7100's — the latest Ultra Linear System from Sony for great sound right across the spectrum. Combines 8″ woofer with 1″ dome type tweeter.

Together they make beautiful music that will charm you — just as it did the man in the white coat.

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ELECTRONICS Australia

Australia's largest-selling electronics & hi-fi magazine

VOLUME 35 No 10

THIS NEW HOMODYNE tuner has been designed in our own laboratory, around locally available parts. It performs well, yet costs little. See the article on page 62.

HI-FI EXHIBITION

SYDNEY HIFI SHOW: The High Fidelity Industry Association has announced the appointment of IPC Exhibitions Pty Ltd to organise a display of quality sound equipment in the Centrepoint Complex, in the heart of Sydney's business area. Scheduled for August, the display will seek to introduce high quality sound equipment to the public at large. It will be promoted through magazines, newspapers, radio and television. Arrangements are in the hands of Mr Tony Farrington, who can be contacted at IPC Exhibitions Pty Ltd, 3-13 Queen St, Sydney, Ph 69-5651. (IPC Exhibitions has an inter-company association with "Electronics Australia").

On the cover

The electro-acoustic control console for the main concert hall at the Sydney Opera House, one of the eight consoles in the very comprehensive electro-acoustic system supplied by Amalgamated Wireless (A'sia) Ltd. The system won the Prince Philip Prize for Australian Design Certificate of Merit.

CONTENTS — JANUARY 1974

world of electronics and hi-fi

projects and technical

regular features

The goal of every audio enthusiast...

(that elusive sense of actually being there)

True concert hall reproduction is unobtainable through the conventional speaker system for one very basic reason. The conventional system projects nearly all of its sound directly at the listener. Yet, in the concert hall the majority of sound, nearly 90% is reflected or indirect. So, even if your system will reproduce a sound exactly as played in the concert hall, your ear will not receive it in the same manner.

Unless of course, you have the Philips Quadreflect Loudspeaker System. The quadreflect is designed around this very principle of reflected sound. Comprised of three rear "Sound Planes" which project sound left, right and upwards, reflecting off adjacent walls and then combining with the right proportion of direct sound from a fourth "frontal" plane, the system completely envelopes the room with sound, giving a degree of realism unmatched by conventional systems.

The ultimate in concert hall reproduction, this system comprises no less than three 1" dome tweeters, four 7" woofers (per box), is capable of 80 watts rms per channel and can, under ideal conditions, give a flat response from as low as 32 Hz to over 20 kHz.

Philips Quadreflect
Loudspeaker System.

Rear view of Quadreflect with grille cloth assembly removed.

PHILIPS

You can hear the Quadreflect System demonstrated at Magnetic Sound, 387 George Street, Sydney,
J. Magrath, 208 Little Lonsdale Street, Melbourne,
Challenge Hi-Fi Stereo, 96 Pirie Street, Adelaide,
Genacs Pty. Ltd., 46 Milligan Street, Perth,
TEL-AIR Electronics, 187 George Street, Brisbane.
Or write for detailed brochure to ELCOMA,
P.O. Box 50, Lane Cove, N.S.W. 2066.

ELCOMA

ELECTRONIC COMPONENTS AND MATERIALS

(The Quadreflect System is also available in kit form)

153.53

EDITORIAL VIEWPOINT

New year resolution . . . .

Executives throughout the electronics industry will surely have welcomed the holiday break, which has given them a respite before having to face up to the problems of the new year. And problems there will surely be.

The Tariff Board made its contribution early by recommending a substantial reduction in the protection offered to the local manufacture of small components. Companies in question might have been motivated to abandon such activity immediately but for one thing: components are in very short supply around the world and the demand for local products may continue for some time, tariffs and prices notwithstanding. What a situation against which to make future production commitments!

The component situation will, of course, continue to plague parts suppliers, involving increased cost, delay in supply and the likely loss of goodwill. And yet, the demand for components has never been stronger. Maybe we'll all have to take a few extra lessons in tolerance and patience!

And what of the hifi field? Again, interest and demand are at an all-time peak, with the public interested in everything from cassettes to quadraphonic. The tariff decision will have only a minimal effect but the overseas fuel crisis has already placed an enormous question mark over production, prices and shipping. Executives in the industry will need the wisdom of Solomon to follow any kind of a planned path through such open-ended circumstances.

And colour television?

Before the year is out, receivers must be finding their way into many homes to ensure at least a representative audience for the first official transmissions. But how are local manufacturers going to fare behind a tariff barrier which they have maintained would be totally indadequate? Will they be assisted by a licensing system which could exclude all overseas receivers for two years? Will "standards" really exclude non-PAL receivers?

Or are the skids already under the PAL licensing system?

One could go on adding to these potential problems, and we in the publishing industry have a few of our own that we have to face.

But, so what! I remember rather wryly a former boss who dismissed all my protestations with one stock phrase: "It'll give you a chance to show how good you are!"

That's the spirit in which we'll all have to face '74!

Neville Williams

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ADC 10E mk4 . . . . $45.00

Type: Induced Magnet*
Output: 4 mV at 5.5 cms/sec. recorded velocity
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Frequency Response: 10 Hz to 20 kHz ± 2 dB
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Compliance: 35 x 10^{-6} cms/dyne
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MODEL AS-203A

FEATURES
Although this model may be called a budget type speaker, the combination of each specially designed 8" woofer, 5-1/4" midrange and 3-1/2" cone tweeter all of which are mounted in a professional quality enclosure will surely bring you pleasant musical memories.

TECHNICAL SPECIFICATIONS

Speaker Complement:	8" Woofer 5-1/4" Midrange 3-1/2" Cone Tweeter
Power Handling Capacity:	35 Watts (music program)
Impedance:	8 Ohms
Frequency Response:	45 ~ 21,000 Hz

MODEL AS-250A

FEATURES
The As-250A is the latest 3-way 4-speaker system incorporating a 10-inch high compliance woofer with massive magnet and long throw coil to minimize distortion. The new 6-1/2" sealed back midrange speaker is designed to match the woofer unit. Two 3-1/2" cone type treble drivers assure non-directional clean reproduction of the high-frequency range.

TECHNICAL SPECIFICATIONS

Speaker Complement:	10" Woofer 6-1/2" Midrange 3-1/2" Cone Tweeter x 2 pcs.
Power Handling Capacity:	45 Watts (music program)
Impedance:	8 Ohms
Frequency Response:	35 ~ 21,000 Hz

MODEL AS-304A

FEATURES
Model AS-304A is a tastefully styled and highly efficient speaker system designed for low to medium power music systems. This system has a separate high compliance woofer, acoustically isolated midrange, a 3-1/2" cone type low-treble unit and a wide dispersion horn type ultra high-treble unit for smooth transition from lows to highs thereby providing thrilling sound over the full orchestral range. Highly efficient operation assures rich, full-bodied sound even with low-power amplifiers.

TECHNICAL SPECIFICATIONS

Speaker Complement:	12" Woofer 6-1/2" Midrange 3-1/2" Cone Tweeter Horn Type Tweeter
Power Handling Capacity:	60 Watts (music program)
Impedance:	8 Ohms
Frequency Response:	30 ~ 21,000 Hz

MODEL AS-331A

FEATURES
This revolutionary high-compliance speaker system has a silky smooth, balanced sound with well-dispersed highs, and lows which can really be felt, rather than merely heard. Its gorgeous enclosure built of choice woods and superb sound will surely give you maximum enjoyment. You need not worry about speaker blowout because the built-in input over-load protector functions instantaneously when accidentally overloaded beyond the maximum power of 70 watts.

TECHNICAL SPECIFICATIONS

Speaker Complement:	12" Woofer 6-1/2" Midrange 3-1/2" Cone Tweeter x 2 Horn Type Tweeter
Power Handling Capacity:	70 Watts
Voice Coil Impedance:	8 Ohms
Frequency Response:	25-21,000 Hz
Tone Adjustment:	Push Button 3-Way Tone Controls

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. . . Audio

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Feeling comfortable is another part of the PRO-B VI. This comes from replaceable Con-Form ear cushions and a completely adjustable headband. Plus 15 generous feet of coil cord, with a clip that attaches the cord to you, and eliminates any tug on your head. In case you feel like dancing.

For $68.00, you can feel more than you've ever heard. Superex guarantees it for two years. Have a good listen. And you'll hear why Superex is the best sound investment around.

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Superex Electronics Corp., 151 Ludlow St., Yonkers, N.Y. 10705. Distributed in Australia by Jervis Aust P / L, PO Box 6 Brookvale, NSW 939 2922.

Our new 60-watt receiver. For people who want more power than a 100-watt receiver.

It isn't hard for some high fidelity companies to turn a 40-watt receiver into a 100-watt receiver. All they have to do is overestimate their own power.

Instead of testing their receivers at every audible frequency, for instance, they use one easy-to-reproduce frequency. Or they use "peak power" or "IHF" watts instead of true RMS watts. Or omit distortion figures.

This is similar to computing a golf score by counting only the best holes. The results look terrific but they don't correspond with reality.

You can avoid this sort of inflation by buying the new Harman-Kardon 630 receiver.

The 630 produces 30/30 RMS watts at less than 0.5% total harmonic distortion from 20Hz to 20kHz, both channels driven simultaneously into an 8-ohm noninductive load at standard line voltage.

Which is more than many 100-watt receivers can say, and that's why they don't. (If the power rating of a receiver isn't phrased exactly this way, you owe it to yourself to be suspicious.)

But the 630 not only gives you more power than so-called 100-watt receivers; it makes better use of the power.

The 630, like our 90-watt receiver (the 930), uses a unique system called "twin power."

Other receivers have only one power source, which lets them function perfectly well with quiet musical passages. But when a sudden tone burst comes along, one channel robs the extra power it needs from the other channel—weakening both and creating distortion in the process.

The 630 eliminates this in-fighting between channels by having an independent power supply for each. So no matter how difficult the musical passage, both channels can handle it flawlessly.

Of course, all of this has a price. Fortunately, it's a moderate one: $398.

For that, you can buy a receiver with more watts than ours. But you can't buy one with more power.

For more information, write to
Jervis Australia, P.O. Box 6, Brookvale, NSW 2100
or phone 939-2922

harman/kardon
The Music Company

MARANTZ
answers the 4-Channel Question

Marantz alone presentes products that will change with the advances in 4-Channel design. Our refusal to build in the three current 4-Channel decoding systems is based on one very good reason. We have no desire to produce and market a product that may become antiquated before the end of the year, thus destroying the credibility of Marantz in the eyes of our dealers and particularly our customers.

Providing all three systems (SQ, QS, CD-4) in one package at a competitive price requires sacrifices in other areas of that product, such as power and features. This would be an acceptable compromise if all three 4-Channel systems will be used by our customers but in fact, in a short time you will be using only one of the three systems. And, the system you will be using will be made obsolete by advances in technology. Marantz does not want to say "Buy a Marantz and pay for three 4-Channel systems, but you will only use one of them. And, the one you use will soon be made obsolete by advances in product design, such as SQ full-logic."

What Marantz does say is, "Buy A Marantz and pay for a system that you can use today and tomorrow; A system that does not waste money on features that will become obsolete and/or never be used." We can make this statement because Marantz built a number of unique features into their 4-Channel equipment.

A PLUG-IN, PLUG-OUT POCKET:
You can up-date any Marantz unit when and if you wish by purchasing an inexpensive Decoder module. An example of the use of the pocket would be the new, full-logic SQ IC chips soon to be available, which Marantz is producing. With a Marantz unit you need only plug in our module. On the other hand, the consumer that purchases a unit with everything built in will not be able to take advantage of this new technology without going to great expense, and paying for items such as the cosmetics of an accessory chassis, power supply circuits, etc. In fact, he is stuck with an obsolete receiver or amplifier.

VARI-MATRIX:
A Marantz-designed matrix circuit that synthesizes 4-Channel sound from stereo sources and does an adequate job of decoding SQ and QS program material. Since the Vari-Matrix is a synthesizer, and will provide a 4-Channel effect from any program source, it will always be useful.

BRIDGING:
Marantz provides a bridging circuit on all of their 4-Channel products that will convert the four amplifiers into a stereo amplifier. A nice feature if you want stereo now and 4-Channel later, or if you want more power from your total system by bridging the front channels, and adding an additional 2-Channel amplifier for the rear channels.

DOLBY:
The Marantz philosophy of non-obsolescence is also evident in the design approach used to build Dolby into a number of the 4200 series receivers. Because Dolby is a fully-developed process and is accepted as the industry's standard for noise reduction, the Dolby system can be used today and to-morrow with any type of tape machine. And, will even process Dolby records when they become available. Building the Dolby system into our receivers creates many advantages. Among these advantages are:

COST REDUCTION: Since the Dolby circuit is built into the receiver's chassis, additional costs for separate power supplies and chassis are not accrued.

VERSATILITY: The Marantz Dolby system can be used with any type of tape or recorder. Complete calibration controls assure maximum flexibility of the unit.

Marantz continues to lead the industry with high-quality, innovative product design. Our products offer the flexibility and features that assure our customers an absolute value and quality that is offered by no other company. This is why Marantz has chosen the approach to the industry's 4-Channel dilemma that the new products solve today, without being obsolete tomorrow.

AURIEMA (AUSTRALASIA) PTY. LTD., P.O. BOX 604, BROOKVALE. 2100

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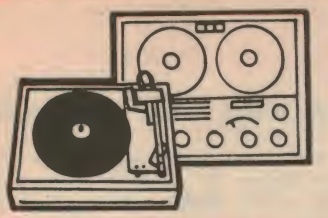


Hi Fi News

Design of 4-channel cartridges

During recent weeks there has been an interesting divergence of opinion between two of the major manufacturers on the subject of quadraphonic pick-up cartridges. Is it, or is it not realistic to envisage one high performance cartridge for CD-4 and matrixed — or other stereo — discs?

All such discs are supposed to be compatible to the extent that they can be played on a modern stereo system and will produce an acceptable two-channel stereo result. Similarly, existing two-channel stereo discs can be played either on a CD-4 or a matrix player with normal frontal sound. In short, hifi enthusiasts can play new records on existing equipment, or existing records on new equipment with a fair degree of freedom and satisfaction.

It is also true that a variety of record playing equipment is on sale, using a single pickup, which can cope with any likely microgroove format: Mono, two-channel stereo, matrix of one kind or another, or CD-4. The same cartridge is used and only the amplifier is switched, manually or automatically, to suit the particular format.

As we have remarked earlier in these columns, high quality equipment of this type leaves little to be desired, in terms of sound performance.

But the question, which so typifies hifi buffs of all generations, is not a matter of whether a universal cartridge is practicable, or even if it works well. Rather is it whether such a cartridge is really optimum in both or all roles. Could there be a tangible benefit in having at least two cartridges available to plug in — one for CD-4 the other for the more conventional systems?

In a recent letter to the Editor of "Audio" magazine, James H. Kogen, Vice President of Shure Bros Inc, set out the present thinking of his company's engineers. He expressed the view that a cartridge designed to cope with CD-4 discs would most likely end up with a playing weight considerably greater than might otherwise be necessary, and that this was an undesirable price to pay for the dual role. Kogen said:

"Shure's position is that we will provide the best quality cartridge for all record formats that are produced. We will certainly endeavour to satisfy the requirements of the CD-4 system, as well as the matrix and standard stereo.

"This does not mean, however, that we — or other cartridge manufacturers — can produce a single cartridge that will be the ultimate solution for all systems. It may be that several cartridges will be required, each being the optimum for a given system.

"In the case of the V-15 III, our objective was to provide the finest phono cartridge possible for the present-day standard stereo disc. This does not mean that we intend to ignore the CD-4 system or any other system. It simply recognises the fact that the number of CD-4 discs available today is miniscule compared to the millions of standard stereo discs that have been produced over the past 16 years. Even today, the Schwann catalogue of records shows approximately 30K stereo discs and certainly fewer than 30 CD-4 discs.

"The V-15 III has been optimised to satisfy the requirements of the standard stereo disc.

"The V-15 III will track most present-day records at ¾ gram. Cartridges being sold for operation with the CD-4 system are specified at two grams. The design of a cartridge that will play satisfactorily at ¾ gram is significantly different from that which will play at two grams.

"We feel that the lower tracking force is an extremely important feature of a top-quality stereo cartridge. We have run extensive life tests, which show that the life of a diamond tip increases exponentially as tracking force decreases, as long as the cartridge tracks properly.

"For cartridges in the price range of the V-15 III, we believe that extending the life of the stylus is a feature we owe to our customers. We could not, therefore, countenance a change in the design of the V-15 III that would require a higher tracking force.

"We have tested all of the CD-4 cartridges that we have been able to find, not only for sale in the United States but in Japan and Europe as well. All of these cartridges have a rise in frequency response above about 15kHz, with a peak in the 25 to 30kHz region, approximately 10dB above the 1kHz level.

"The frequency response I have described indicates a major resonance in the 25 to 30kHz region. A flat frequency response out to 45kHz would require either a major resonance beyond 45kHz, or a very highly-damped stylus system. Both possibilities would require a dramatically different approach from that of present-day cartridges. Most probably, successful CD-4 cartridges will show a resonance around 30kHz, with a fairly significant peak. In order to provide proper trackability for these cartridges, a tracking force in the two-gram region is indicated.

"One of the problems in developing a cartridge for the CD-4 system is that the system itself is still undergoing development and improvement.

"In the case of stereo, once the Westrex cutter had been intoduced, people produced stereo records; and the phonograph cartridge was designed to satisfy a reasonably fixed objective. In the case of CD-4, there have been numerous improvements in the technique of mastering the records and also in the electronic circuitry for decoding the signal. There also have been changes in the record materials.

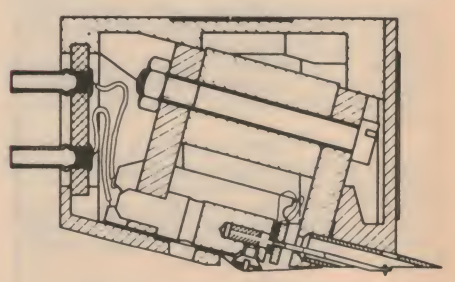
"Designing a cartridge to satisfy the requirements of the CD-4 system, as well as the ear of the trained high-fidelity listener, is not a static task.

"We believe that it is necessary to produce a cartridge designed specifically for the CD-4 system. At the present state of the art, such a cartridge will be able to perform adequately with standard stereo records; however, we do not believe such a cartridge can approach the ultimate in reproduction of standard stereo records. For such reproduction, we offer the V-15 III.

"Perhaps, some day in the future, the qualities of these two cartridges may be combined and the ultimate may be offered for both systems simultaneously. Until then, we feel that individual cartridges optimised to satisfy each system should be provided."

James H. Kogen,
Vice President,
Shure Bros, Inc,

Against this background, it is interesting



The two cartridges which illustrate diverging design approaches. Below is the Shure V-15 III, at right and lower right the Ortofon SL15Q.

HIFI NEWS

to read the sales literature on the latest cartridge from the famous firm of Ortofon Manufacturing A/S, Copenhagen. It describes their new SL15Q moving coil cartridge, especially designed for the CD-4 system and with a response to 45kHz. If Ortofon have any reservations about its suitablility for conventional stereo and matrix discs, they are certainly not expressed!

We quote:

"The CD-4 system developed by JVC / R-CA (CD-4 standing for compatible discrete 4-channel) requires a frequency response of up until 45kHz. The SL15Q cartridge was designed to meet this requirement, but the cartridge is as well suited for playing other 4-channel records and of course normal stereo and mono.

"The most important requirement to a CD-4 cartridge is extended frequency response up to 50kHz. JVC gives the tolerances for a pick-up of highest class as shown in Fig 2. Separation at the carrier frequency, 30kHz, is also an important figure. Low moving mass and a very concentrated pivot point, together with high compliance, are all part of the framework on which to build a CD-4 cartridge. Fig 1 shows the frequency response and separation for the SL15Q in relation to the JVC limits.

"Like its predecessor SL15, the SL15Q is a moving coil cartridge. (See Fig 2. It

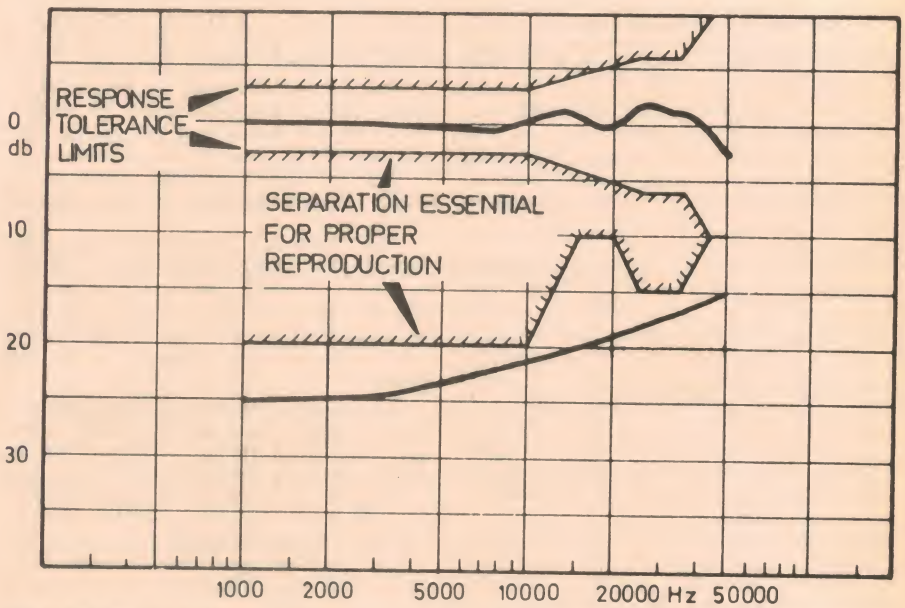
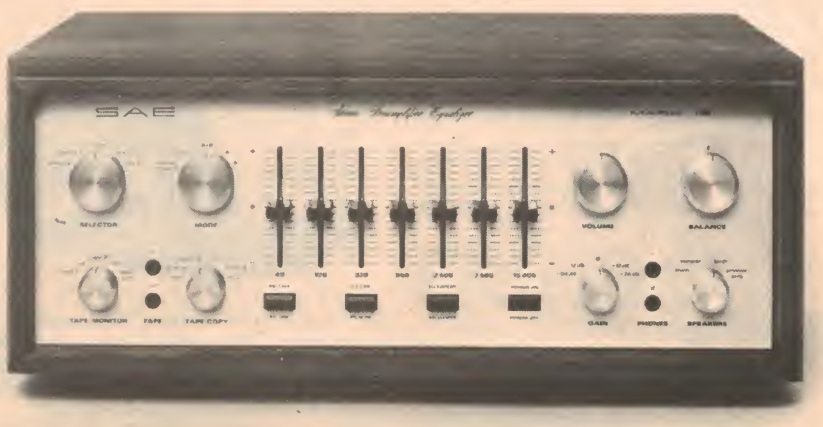


Fig 2: Frequency response and separation curves for the new Ortofon CD-4 cartridge SL-15Q. The diagram also shows the JVC tolerances for CD-4 cartridges.

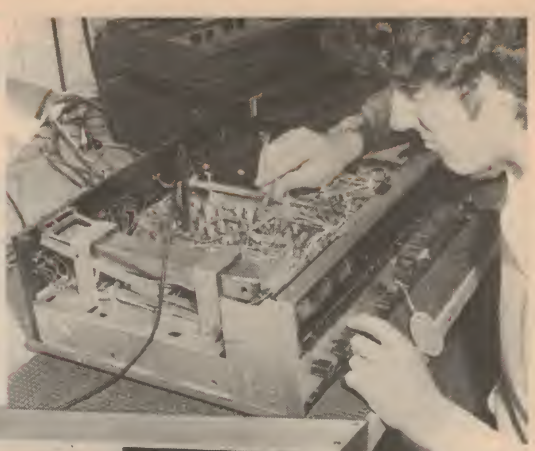


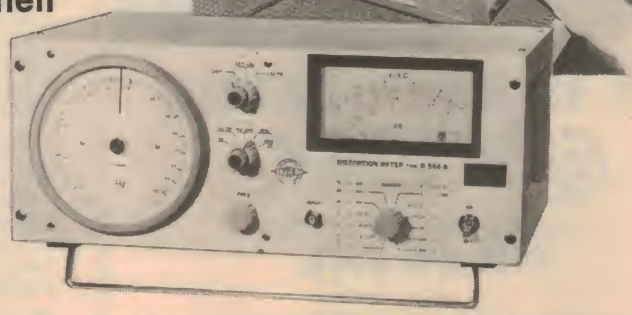
Leroya Industries Pty Ltd announce that they have been appointed as sole distributors for Scientific Audio Electronics of California. SAE manufacture state-of-the-art power amplifiers, preamplifiers, equalisers and loudspeakers. Pictured is the SAE Mk 18 stereo equaliser preamplifier which has "graphic equaliser" tone controls.

In the SAE Mk 18, the graphic equaliser controls apply boost or cut over a range of frequencies roughly an octave or so wide at seven points in the audible spectrum. This enables better compensation for loudspeaker irregularity and room acoustics than can be provide by conventional "variable slope" tone controls.

No need to get in a flap over fixing AUDIO/HI-FI gear

Not with this selection of instruments from Jacoby Mitchell to iron out your problems.





TES Model D 566 B AUDIO DISTORTION METER

Fully transistorised, easy to operate distortion meter. **Distortion Meter:** Freq. range 10 Hz to 1 MHz • Distortion factor 0.03% to 100% • Input impedance 100 KOhm; 40 pF. approx. **Millivoltmeter:** Voltage range 1 mV to 300 V f.s.d. • Level range (rel. to 0.776 V) + 52 dB to − 75 dB Freq. range 10 Hz to 2 MHz • Input impedance 2 MOhm; 50 pF approx.

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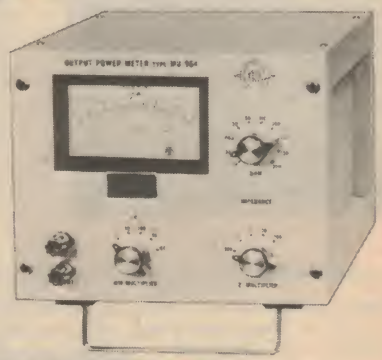
ADVANCE DMM2 DIGITAL M/METER

An inexpensive 3½ digit DVM for AC & DC voltage, current and resistance • All push button with the stability of LSI (large scale integrated circuit) • Voltage range 200 mV to 1000 V, current range 200 μA AC & DC with up to 2A with SP-2 current shunt • Resistance ranges 200 Ohm to 2000 KOhm • Accuracy 0.19 DC • Weighs only 3½ lb.



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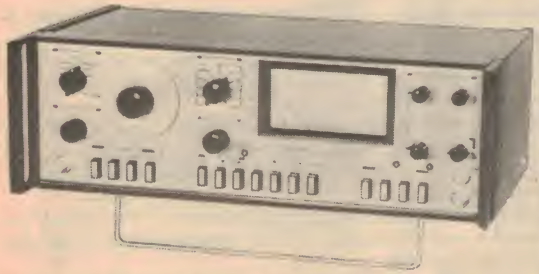
Fully transistorised power meter calibrated in watts and dB. Built-in load resistance • Power measuring ranges 1-10-100W • Freq. range 20 Hz to 50 KHz • Accuracy within 0.5 dB • Load input resistances 4-8-16 ohms • Resistances accuracy better than 5%.

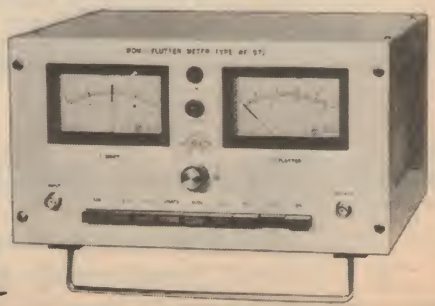


FERROGRAPH RTS-2 AUDIO TEST SET

An "all-in-one" test set to check frequency response, signal noise ratio, distortion, cross talk, wow and flutter, drift, erasure, input sensitivity, output power and gain. The facilities of the RTS-2 can be extended with the RTS Auxiliary Unit. The RTS-2 offers many advantages over conventional methods of obtaining these measurements which would require a number of separate test instruments.

TES WF 971 WOW & FLUTTER METER

For tape recorder servicing • Spec. DIN & CCIR • Input signal 20 mV rms to 20 V rms approx. • Frequencies (switchable) 3150 Hz and 3000 Hz • Ranges (flutter) ± 0.1% ± 0.3% ± 1% f.s.d. • Drift Indication ± 2% max. • Input impedance 10 KOhm max. • Built-in oscillator 3000 Hz or 3150 Hz switchable • Stability better than 0.1%.



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JM/149-73

HIFI NEWS

consists internally of two orthogonal coils held in a powerful magnetic field. These coils are fastened to one end of a light cantilever which also holds, at its other end, the diamond stylus. The assembly is pivoted close to its centre of gravity so that little force is required from the record to obtain movement of the coils.

"The special stylus has a larger area at the point of contact with the record than an elliptical stylus. Ortofon describes it as "bi-elliptical." Because of the enlarged contact area, the compliance of therecord vinyl is lower, making the resonance frequency between this compliance and the moving mass, which has also been reduced, very high.

"The extremely small moving parts present special problems in manufacture. Cantilevers are assembled under magnifying glass (5X) and the coil is handwound under a microscope (20X). The wire is so fine (0.035mm) that 1kg would suffice for 1 million cartridges!

"Various measurements have been carried out to establish the distortion level of the new cartridge. In particular the trackability test record TTR-103 from Shure with 10.8kHz pulsed signal is useful. The distortion level at a maximum peak velocity of 30cm / sec is 0.3pc with a tracking force of 1.5 grams.

"A new test record 20Hz — 45kHz sweep has been made by three Danish companies Bruel & Kjaer, Bang & Olufsen, and Ortofon. It will be released by the three companies under each company's label. It is hoped that this new record will become a laboratory standard, just as the old B & K test records have been.

Technical Data

Equivalent stylus tip mass	0.7 mg
Compliance Horizontal	25 micro cm / dyne
Vertical	15 micro cm / dyne
Tracking force	1.5 grams
Trackability (300Hz)	50 um
Electrical load	R — 100k ohms
	C — 100pF
Output voltage (1kHz)	
without transformer	0.015 mv / cm
with transformer	1.5 mV / cm

Such then are the apparent design philosophies of Shure and Ortofon, both highly respected in the field of cartridge design.

Why the difference?

In fact, the conflict is not as basic as might first appear. Shure is virtually saying: We can offer you a cartridge which will track all your conventional and matrix records at less than 1 gram. If we had to build into such a cartridge a CD-4 capacity, we would have to opt for about twice the playing weight. Why impose needless wear on your stylus and your present discs for the sake of, as yet, a very small number of CD-4 discs?

Ortofon virtually proves the Shure argument by offering a cartridge that does in fact, track at 1.5 grams. But Ortofon is saying: Our new cartridge, with its special stylus, offer top-flight performance, with wear not a significant problem. Why have two cartridges when one will do the job?

And, somehow, we think that debate along these lines is going to mushroom within and between equipment manufacturers the world around, and all the way down from the performance leaders to budget-priced products.

Before leaving the subject of quadraphonics, it was most interesting to read a report about a JVC development involving the the standard tape cassette.

Quadraphonics on cassette has been a thorny question for some time because, allegedly, the Philips organisation has been keen to preserve full compatibility between all cassettes: mono, stereo and presumably quadraphonic.

The idea put forward by some, of running four side-by-side tracks in one direction over the full width of the tape conflicts with this, because the cassette would not be reversible.

The alternative of sub-dividing the stereo pair into four tracks each way has largely been ruled out to date because of tape control problems and signal-noise ratio. There are difficulties enough with four tracks on the narrow tape, let alone eight tracks!

So, for some time, the industry has faced the curious proposition that cassettes could only be used for matrixed quadraphonic, with CD-4 as a distant possibility. Separate, discrete tracks . . . no!

Now comes the following report:

"JVC have announced the release of the 4CD-1680, an eight-track four-channel cassette deck. The 4CD-1680 is the first production machine to employ eight tracks on standard 0.15 in tape. This has been made possible by the development of a new high-precision head, to be known as the 'Cronios'. The system is fully compatible with the standard stereo cassette.

"The use of such narrow tracks poses several problems (more

accurately it extends the usual cassette problems). Tape hiss would be unacceptable without some form of noise reduction system, and JVC have elected to use their own system for this rather than the ubiquitous Dolby. ANRS as it is known is a dynamic noise reduction unit that progressively boosts signals above 500 Hz during recording, and attenuates them during playback. This results in a signal to noise ratio of 48dB.

"Crosstalk has been minimised by the use of electronic circuits using phase shift techniques, and JVC claim a crosstalk figure of 25 dB at 1kHz. The deck also features two independent drive systems, and full provision for chromium dioxide tape equalisation." (Price to be announced.

New Sansui cassette deck

Still on cassette decks, the Sansui SC737 stereo cassette deck has just been released in Australia by the Bleakley Gray Corporation. It replaces the SC700 which has been one of the most popular cassette decks with the audio enthusiast.

Claimed features of the SC737 are Dolby B noise reduction system, a new type of "Magni-Crystal ferrite head for recording and play-back, a precision built tape transport and really outstanding electrical characteristics.

Frequency response of the new Sansui deck is 35 to 14kHz plus or minus 3dB, signal to ratio is 50dB without Dolby while cutting the Dolby circuit in gives a further noise-figure improvement of 8dB. Wow and flutter is a low 0.11pc.

SC-737

An automatic electro-optical shut-off device protects both the tape and the transport mechanism against overload at end of tape and if jamming occurs. A newly developed 4-pole hysteresis-synchronous motor is virtually unaffected by fluctuations of mains voltage or tape tension and results in the very low wow and flutter figures.

There are several other unusual features of the SC737 which contribute to its high overall performance. So confident are they about the appeal of this new deck that Sansui have issued an interseting challenge. They invite users of tape recorders to compare the actual performance of the SC737 with any reel-to-reel recorder, including those made by Sansui.

Further information on the new model can be had from hifi stockists or the Australian distributors of Sansui, Bleakly Gray Corporation.

New Marantz equipment

The Marantz Company of Sun Valley, California has introduced a new floor-standing loudspeaker system to their Imperial range. Imperial 8 is intended for high power stereo or 4-channel high fidelity systems but it has high efficiency to enable it to perform equally well with moderately powered amplifiers.

Six loudspeakers are used with a three-way cross-over network to cover the audio range. A highly developed 12-inch woofer provides bass response down to 40Hz within plus or minus 2dB. Three midrange and two high requency tweeters are arranged in what Marantz term a "rotatable array" so that two loudspeakers systems can be arranged to "look" like mirror images in a stereo set-up. Apparently, the five speakers are mounted on a circular section of the baffle which can be rotated by hand to give the best orientation.

THE BIG APPEAL

Some people want the big sound. This is it. Sony's gleaming TA-1150 amp delivers a whacking 35W RMS per channel — enough to comfortably drive two of the finest speakers on the market today — Sony's massive top-of-the-line SS-7600 Ultra Linear Systems that put the Sydney Opera House in your living room. Add Sony's beautiful belt-drive SS-5520 turntable and you've got a complete system that friends would pay money to hear.

Specifics: The Sony TA-1150 has two tape recorder inputs, frequency response 12 Hz-20 kHz, harmonic distortion less than 0.2% at rated output. All desirable controls and inputs. Direct coupling circuit.

The Sony PS-5520 turntable features aluminium diecast platter and belt drive for faithful and flawless reproduction. Diamond stylus and induced magnet type stereo cartridge.

The Sony SS-7600 Ultra Linear Magnetic Circuit speaker system features 3-way, 3-speaker combination with 12" woofer, 5" mid range and 1" horn type tweeter. Power handling capacity 100W. Front panels are detachable to reveal individual brilliance controls.

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HIFI NEWS

Overall frequency response is rated at 40Hz to 18kHz within plus or minus 2dB or from 35Hz to 20kHz within plus or minus 5dB. Power rating is 75 watts continuous or 125 watts on music signals.

Marantz Imperial 8 loudspeaker system.

Dimensions are 593 x 686 x 458mm (w x h x d) and the nominal impedance is 8 ohms. In line with the latest trend, a sculptured foam grill is fitted.

Australian distributors for Marantz equipment are Auriema (Australasia) Pty Ltd, 549 Pittwater Road, Brookvale, NSW 2100.

AIWA Cassette Deck

Goldring Engineering (A'Asia) Pty Ltd now have available the new luxury Aiwa AD-1500 stereo cassette deck which has all the recognised high performance features such as Dolby B noise reduction and automatic bias and equalisation changeover for CrO2 tape as the cassette is loaded into the well.

Manual switching is also provided for selecting equalisation and bias condition to suit different types of cassette tape. Six slider contrôls are provided for microphone and line mixing and for output level control. A ferrite record-playback head assures low head wear.

Aiwa AD-1500 stereo cassette deck.

A unique styling feature of the deck is the perspex dust cover which will stop dust building up on the horizontal control panel.

Further information can be had from Aiwa stockists or Goldring Engineering (A'Asia) Pty Ltd, 26-28 Ricketty Street, Mascot, NSW.

Sony have a new stereo amplifier which has a large number of control functions but manages to have a fairly clean simple layout. Eleven pushbuttons provide the input and output control functions while two slider knobs are used for the volume and balance controls. Continuous power rating is 18 watts per channel into 8-ohm loads or 22 watts per channel into 4-ohm loads.

Balanced positive and negative supply ails are used in the power amplifier sections to enable direct coupling to the loudspeakers. This results in extended power bandwidth and good damping factor at the low frequency end of the spectrum.

Further information can be had for the Australian distributors for Sony, Jacoby, Kempthorne Pty Ltd, 469-475 Kent Street, Sydney.

STILL SEARCHING FOR HI-FI STEREO TREASURE?

YOU'LL DISCOVER IT WHEN YOU VISIT YOUR FRIENDLY BLEAKLEY GRAY DEALER.

Let's be brutally frank. Some hi-fi equipment offers more value than others. Your Bleakley Gray dealer carries a range of hi-fi products which are firmly established on the world markets, backed by effective guarantees and after-sales service. This is the range which offers more *audible value for your money.*

Your Bleakley Gray dealer sells Sansui equipment. *In his stock you will also find:—*

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AMPEX — America's finest recording tape and cassettes. Ask about the brilliant new 20/20 tape — available in reels and cassettes.

ORTOFON — Danish made tone arms and stereo cartridges. The brand chosen by professional users. Listen to the new M15 Super stereo cartridge — which offers the *lowest distortion* ever!

SILCRON — Australian designed and made belt driven turntables. *Silent and reliable.* Available with arms, bases, covers, etc.

TANDBERG — Norwegian tape recorders and cassette decks. The recently released cassette deck, the TCD-300 is, without doubt, *the best cassette deck available in the world today.* Tandberg reel to reel machines also offer a standard of reproduction *audibly better* than any similarly priced deck.

THORENS — Swiss transcription turntables. The electronic TD-125 Mk II is the unit selected by many of the world's reviewers and electronic buffs. Demand for the less expensive TD-160 still exceeds supply in both European and overseas markets. Both models available with and without bases, arms, etc.

WATTS — Record cleaning and maintenance equipment: The "Dust-Bug", Disc Preener, Humid Mop and Manual Parastat. *Effectively maintains your records in as-new condition.*

WHARFEDALE — Probably Australia's most comprehensive range of fully compatible stereo equipment — amplifier, cassette deck, sound source (turntable, etc.), headphones and no less than eight speaker systems. Backed by over forty years manufacturing *"know-how"* by the most experienced audio engineers in the U.K.

Need more proof? Visit your Bleakley Gray dealer. *Soon.* See for yourself just how much more audible value you get from his comprehensive range. And sleep easily, knowing your equipment is *fully guaranteed, extremely reliable . . .* and *your money's been wisely invested.*

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CLASSICAL RECORDINGS

Reviewed by Julian Russell

Bizet — Carmen — Leonard Bernstein

BIZET — Carmen. Complete opera in almost its original form. Marilyn Horne (Carmen); James McCracken (Don Jose); Tom Krause (Escamillo); Adriana Maliponte (Micaela) and others with the Manhattan Opera Chorus, Metropolitan Opera Children's Chorus and Orchestra conducted by Leonard Bernstein. DGG Stereo 2740-101. Three discs in box with handsome brochure.

The question of how to present Bizet's Carmen — the accent, by the way, is on the second syllable — has vexed producers and artists ever since its first performance. It was originally written as a drama with music for the Paris Opera Comique, the traditional home of such works. It was premiered there just on 100 years ago — in 1875 — and was a scarcely qualified failure. Bizet died three months after. The pill was as bitter for the composer as it had been for the comfortably bourgeois audience of the Opera Comique, at that time a house where one could expect to enjoy family entertainment.

Later the opera was tarted up by many hand.s The spoken dialogue was given musical recitatives and redesigned into a sentimental operatic work suitable for performance in Grand Opera Houses. It was Bizet's early death that has produced all the arguments for and against the changes made in his original version. Would he have or have not approved all the changes? It is a safe guess to write "not."

Since Bizet's death the opera has been pulled both ways, with Grand Opera and Opera Comique as anchor man at opposite ends of the rope. Today, even in the Grand Opera version, some of the more vicious interpellations have been suppressed but, in its Grand Opera form, it remains essentially a sentimental piece with a "boy loses girl" theme. Happily it is not novelettishly resolved, and the principal's surrounding characters changed into picturesque if improbable people. Gone is Bizet's cutting edge, the sudden chilling effect of spoken dialogue and the carefully carved statements of his two fine librettists, Meilhac and Halevy. Even the opera's essential rawness has largely disappeared. Carmen herself is presented as an applause seeking prima donna instead of a female tigress who can snarl even in ecstasy. Yet Bernstein's version comes very close to success and the only recording I have heard that I like better is the Eurodisc with Lorin Maazel conducting.

It may be noticed that both these versions are issued by German companies yet for many years the Germans have thought of Carmen as a German opera, bizarre as this must sound. But the claim is firmly based on their philosopher Nietszche's use of the work as a cudgel to belabour his former friend Wagner. Bernstein for DGG has used, to a very large extent, Bizet's original setting. So did Eurodisc and if I find the latter harder hitting if not altogether equal vocally to DGG's, it is the conductor's reading that seems to me the most important factor.

Bernstein, typically, I think, aims to put a more highly burnished finish on the work than Maazel, who plays it, without apologies, right into the hearts and nerves of his listeners. Bernstein's version still belongs to such opera houses as the New York Met, where it was first performed last year. Maazel's might — and I mean might — be successfully presented at such houses' little brothere where its impact would hit a perceptive audience as with a hammer.

Lack of space prevents a bar to bar comparison of the two so on this notice I will try to confine myself to the Bernstein performance. Bernstein's, or any other conductor's, chief difficulty in giving the original version is to get opera singers to speak their lines like stage actors — and vice versa. A double cast, one for the spoken lines, the other for the sung dialogue, seems a practical answer for a recorded performance. On the stage, this would, of course be impossible. But even with a double cast in a recording most listeners would find the matching of speaking and singing voices a disappointment. Thus you hear some curious French accents in Bernstein's spoken — and often sung — dialogue and, though starting with the best of intentions, he has made slight alterations to the original score, mostly in the form of small omissions, which need not be mentioned here.

However, despite my preference for the Maazel set, the Bernstein performance certainly comes off. It is rhythmically exciting and has the incomparable advantage of Marilyn Horne in the title role — as fine an all-round Carmen as might be imagined. Her characterisation of the part comes closer to its creator's intention than any other I have ever heard, though I am tempted to wonder how it would compare to that of the now legendry Emma Calve's. Horne's voice is in marvellous form throughout its great range. Here is no sweet coy seductress but an anarchic gyspy, taking her pleasures where she can find them, immensely resourceful and just as immensely feminine and with an inborn sense of freedom that will brook no limitations. Nobody could be perfect in such a role but my guess is that you'll have to wait a long time to hear a better. As in the novel on which the opera was built, she completely swallows up her consort, Don Jose (James McCracken) despite his desperate search for dramatic and vocal equality.

I enjoyed immensely, too, the Micaela of Adriana Maliponte, beautifully sung and perceptively acted. Tom Krause's Escamillo is good and masculine if not always as subtle as it might be. But Bernstein's conducting, though sometimes a little uneven, has its own strong individuality. He takes the opening prelude at such a deliberate tempo that, despite its festive climate, it seems to stress the tragedy of what's to follow. The threat in the "death" theme seems almost languid. Yet, in such places as the famous Seguidilla, he balances his orchestra against singer to such perfection that many will hear a counter theme there for the first time.

In Act 2 he takes the Bohemian song very slowly to start with so as to consistently build up excitement to the climax at the end. His Quintet flies along at a Beecham tempo but at times lacks the delicacy of touch of that master.

Yet it is an exhilarating exercise and I was sorry when it had to end. There are some touches you may not have heard or seen before, such as Carmen's breaking of a plate into two pieces to use as castanets in the second act. The Act 3 prelude is a little masterpiece — a nice steady flute tone, an orchestral balance worthy of an apothecary, and all the ingenuity and lusciousness of Bizet's scoring made audible to the crudest ear. Another touch worth waiting for: When the curtain rises on this act the first horn signal to the smugglers is heard at a distance then is echoed closer by the second. A small point perhaps but wonderfully effective. The Card Trio is more or less conventional but Carmen's following song, opening with sinister quietness, building up into a thrilling forerunner of her inevitable death. I have never heard it sung more beautifully.

If anyone ever faced death with dignity you will hear it here. A spine shivering experience. I would have liked to hear more of the marvellous cello figure in the accompaniment to Micaela's aria. Surprising this, because despite Bernstein's care elsewhere it is almost inaudible here. The chorus is always magnificent and the orchestra great. In the last act the almost constant clashing of the cymbals would have sounded intolerably vulgar in most other contexts but here add to the festive atmosphere. The whole set is a splendid achievement but despite the great difference between Anna Moffo and Marilyn Horne in the title role I would like you to hear the Eurodisc, too, if you can find a set. It used to be issued by Philips but is now put out, if any are left, by Festival.

★ ★ ★

PROKOFIEFF — War and Peace Highlights. Soloists, Chorus and Orchestra of the Bolshoi Theatre conducted by Alexander Melik-Pash Ayev. Melodia Stereo OASD7573.

I suppose if you want to get a vague idea about what an opera is like these "highlight" issues might help. But the idea will, unhelped, remain a vague one. Who, for instance, from this two-sided disc running 50 seconds under an hour could imagine the scope of an opera which, before cutting, ran for seven hours, and even in the truncated form given at the Sydney Opera house ran for three hours without counting the single interval. Some of the English music critics who came to Sydney for the opening of the Opera House told me that, presented in its entirety, as a spectacle opera, War and Peace is very impressive indeed. In its cut form used in Sydney and mounted in a theatre too small to mount

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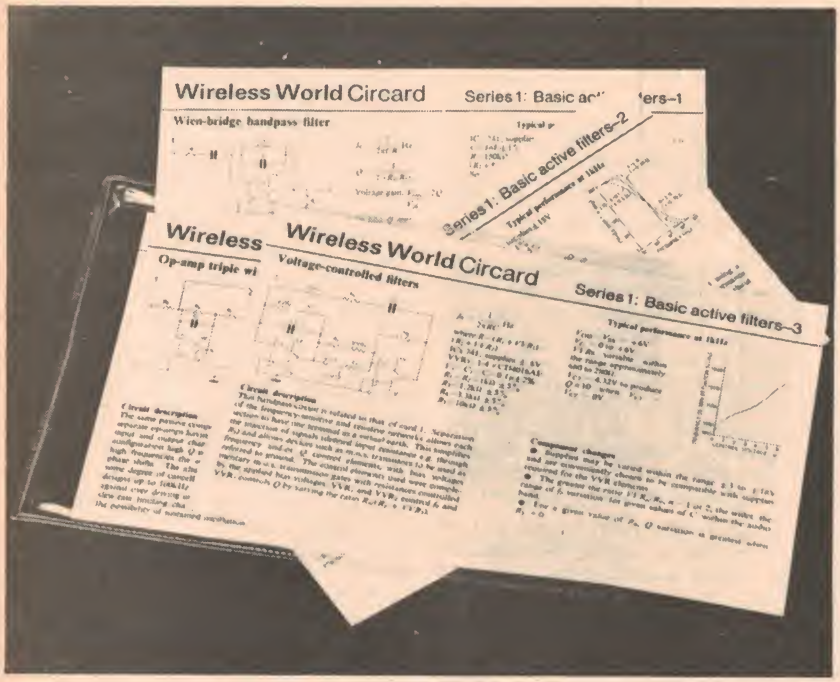

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anything but a pony it tended to be ludicrous, despite the exercise of much ingenuity on the part of the stage designers and scenery makers. The hour-long disc, aimed at picking the best bits, exposes, however, much that is weak in this opera.

War and Peace, though based on the Tolstoi novel of that name, was composed as a propaganda opera in a spirit of patriotic fervour by Prokofieff whose wife furnished his libretto. Now Prokofieff could be, at his best, a very eloquent composer indeed, but somehow or other he didn't seem to respond to the inspiration of war despite the wonderful defence of the Soviet by its millions of heroic citizens. A great English martyr, Nurse Edith Cavell, once said just before her execution by the Germans, "Patriotism is not enough." I feel this statement to be very apt in the case of Prokofieff and War and Peace.

This "highlights" disc contains 10 excerpts from the opera, the longest running 8 minutes 42 seconds, the shortest 2.46. The first item, a duet between two women, I found one of the most mellifluous passages in the Sydney Opera House performance. Since it occurs very soon after the curtain went up I was in great hopes of an enjoyable evening. Alas, things didn't turn out that way, nor do they on the record. The engineering seems to draw extra attention to the wide vibrato that seems inseparable from the voices of Eastern European women singers. One of the singers is Vishnevskaya, the wife of cellist Rostropovich, who when she came to Australia with him a few years ago had a rock steady voice. There are passages in this charming duet where her voice is just as steady but others where she has a distinct wobble. Her partner is Klepatskaya. But, taken all through its brief 3 minutes and six seconds, it makes a charming, tender interlude.

Next, Bolkonsky's Arioso from Scene 1 is sung by baritone Kibkalo. The vocal line is smooth but without much tension working towards an epilogue that improves on what has gone before. As a baritone solo I can't imagine it ever offering any great competition to Verdi's "Eri tu" from Ernani. Then comes four minutes 57 seconds of the famous Waltz Scene. This might well, one of these days, become the most popular item from the opera though it is much more conventional than others by the composer, such as the march from The Love of Three Oranges." And at times, it must be faced, sounds downright banal.

Vishnevskaya goes on to sing Natasha's Arioso from Scene 4 which also opens in waltz time but has a dramatic vocal line above the three-four orchestral part. The Eastern European throb in her voice is very noticeable here. Later in a more cantabile section her voice steadies and becomes much more alluring. The excerpt is brought to a most inconclusive ending. The next item, Scene and Chorus of the Militia (Scene 8), is one only of several fine choruses in War and Peace. There is a quite startling effect with the unexpected entry of a number of side drums beating out a remorseless rhythm. Theatrically it has a most military effect. Among the stage characters some speak their lines (paflando), some almost declaim them in a kind of sung parlando, all successfully designed to give an atmosphere of warlike

confusion. But you have to wait till the last item on this side, Scene on the Field of Borodino and Soldiers' Chorus (Scene 8), for the full effect of the kind of male chorus one expects from a Russian company. Musically you have a perfect picture of the bustle of old time battle preparation — a piccolo rides over the top of all like a solitary fife — you then hear a couple of fine basses, their voices so much alike that they seem to provide a dialogue between twin brothers, followed by more side drums again hammering out an implacable metre. The chorus is really terrific, as rousing as any I've ever heard. Later a single flute conveys the wide sense of desolation.

Side 2 opens with an expressive bass solo by Aleksei Krivchenya in the role of Kutuzov, the Russian commander-in-chief. Yet compared to some of his famous Russian peers he is not quite out of the top drawer. He, like so many others in the cast, has a wide vibrato and his low register is better than his high. However, his item also finishes with another stirring male chorus.

The Burning of Moscow section has Prokofieff handling solo voices in his chorus in the manner of Moussorgsky in Boris Godounov. (How much better this opera would have been had Moussorgsky composed it.) An unnamed Napoleon sings a few bars impressively and there is again a fine chorus to end the excerpt. The disc finishes with Bolkovsky's death scene in a peasant cottage and the finale to the opera.

★ ★ ★

BRAHMS — Symphony No 4 in E Minor. Concertgebouw Orchestra conducted by Bernard Haitink. Philips Stereo 6500 389.

There are now so many alternative versions of recordings of Brahms' Symphonies that most lovers of his music are likely to own at least one. With the great variety of choice available your personal preference is likely to outweigh any critic's recommendation. Yet, if you're looking for a new one, I do urge you not to decide until you hear this reading. For that reason I am dealing with it in rather more detail than usual. Haitink makes the first phrase almost caressing. There is no pugnacious assertion. Later in the first movement Haitink's beat becomes a little rigid though despite this the music never fails to produce the effect of constantly moving forward. I didn't find the middle working-out section of the movement particularly interesting. Tempo and proportions sound right but momentum is missing. However with the return of the first theme it takes on life again, though without the surprising impact it has in the symphony's first few bars.

There is some splendid horn playing, though it might be left unsaid that the Concertgebouw is fine all round, wonderfully accurate and in perfect balance. The tricky handling of a balance that preserves the solidity of Brahms' scoring yet makes every voice audible is outstandingly successful and interest in the movement is completely restored towards the end. The delicacy of balance of the whole recording is particularly noticeable in the opening bars of the second movement, though here the horns, playing very softly at the time, sound a little squashy. The movement is marked Andante Moderato and seems to me a little short on the moderato aspect which gives it rather too solemn an atmosphere though it is all expressive enough in dynamic terms. Interest grows with the introduction of the second subject and there is some fine, moving playing in the rest of the movement.

The famous rumbustious scherzo frolics around sometimes like a frisky elephant, at others like girls around a maypole. I make no qualifications about the indisputable success of this movement and add happily that here there is nothing constricted about the horns' tone in the trio-like middle section.

Haitink makes a comparatively restrained statement of the theme at the beginning of the finale, in my opinion Brahms' greatest orchestral achievement. But it soon becomes obvious that Haitink's idea is to keep plenty in hand for the final climax and you can trace how well this works as you go along. The famous solo bits in the middle of the movement are all splendidly played without sentimentalisation. The formal passacaglia on which the movement is strictly built is so skillfully disguised that it sounds, to an ear not searching for the ostinato theme, like a line of constantly changing melody.

Haitink is careful to preserve the solidity of the movement by not increasing speed with volume. This movement can, of course, be made to sound briefly more exciting, but, to my mind, only at the expense of its classic structure. The sound is first rate.

★ ★ ★

Starlight Chorale — Choruses from operas. Hollywood Bowl Symphony Orchestra and Roger Wagner Chorale conducted by Roger Wagner. Capitol Stereo 10023.

This odiously titled disc with its equally tasteless sleeve and American style printed gush about the contents will interest none but those freshly rescued from the even worse banalities of pop. True there is nothing wrong with the choruses presented. But plucked bleeding from their contexts they won't do much to create interest in what, for want of a better term, is known as "classical" music.

Bizet's Carmen is represented by the chorus from the last act when the crowd greets Carmen and Escamillo before he enters the ring for the bull fight and Don Jose murders Carmen in his absence. It is all as showy as the cover. The Pilgrims' Chorus from Tannhauser is sung well at first — unaccompanied, of course. But the phrasing suggests, in some way, an oratorio choir rather than an operatic chorus. Later it swells up conventionally but finishes off in a very truncated way.

The Triumph Scene from Aida is improved, on my equipment, by a cut back of the treble frequencies. With the ballet music omitted it makes only a shortish item but succeeds in sounding triumphal, and moreover is not cut off cursorily but goes on to the normal end of the act.

I liked the next item, the Waltz and Chorus from Gounod's Faust, the best on the disc. It is played in lively fashion by the orchestra which has more to do here and moreover does it well. Orchestra and choir are well in balance. From memory — I didn't have a score handy — there are some cuts but the music flows smoothly despite them. The Anvil Chorus from Verdi's Il Trovatore is taken at a good brisk tempo, if without very much light and shade. In all the items mentioned so far the diction of the chorus is such that I defy anyone to identify the language used.

The Wedding Chorus from Lohengrin — perhaps better known to you as the Wedding March — the one usually played after the ceremony—is taken a little more staccato here and there than is usual but is otherwise quite conventional.

From Madam Butterfly you have the Humming Chorus — one of Puccini's more banal melodies, its only novelty being that it is hummed instead of sung. This is not meant to disparage either Puccini or Madam Butterfly. I have a vast admiration for them both, and for most of the other operas Puccini wrote. If you are sufficiently interested in such things you might enjoy yourself guessing when the chorus is going to take the next breath — so clearly audible is this intake.

The Soldiers' Chorus from Gounod's Faust completes the recital — a still more banal tune than the one in Butterfly, if that were possible. But it improves a bit in the middle section and at least sounds manly.

★ ★ ★

SCHUMANN — Piano Concerto in A Minor. FRANCK — Symphonic Variations for Piano and Orchestra. Ingrid Haebler (piano) with the Concertgebouw Orchestra conducted by Eliahu Inbal. Philips Stereo 6500 414.

Bearing in mind Miss Haebler's well-earned reputation as a specialist in Mozart's piano music I played the Franck Variations first because I thought I could guess how she would play the Schumann. Somehow I couldn't imagine how she'd tackle the Franck. Hers is an elegant performance though some of the more forceful statements don't carry, at times, all the weight they might. The orchestra is first class, matching its style to the soloist's whatever difference of opinion might exist between them. The balance between orchestra and pianist is faultless. I am afraid that after a little while Miss Haebler's account of the work begins to sound a little staid. Every perfectly shaped sentence sounds a tiny bit matter-of-fact. It is all rather like a beautiful waxwork model than something of real flesh and blood. Here and there, however, it comes to life very excitingly indeed.

The second part of the variations — if this section can be so described — sounds as if it was recorded in an entirely different acoustic environment, without however, making one feel uncomfortable about it. Throughout the pianist's performance one cannot fail to admire the beautiful spacing of the fast passages, even if the total result is a little prim. I can only describe it as an exhibition of the coolest elegance with every accessory in exactly the right place. Towards the coda I thought the balance moved a little towards the pianist's favour and here especially the tempo remains very deliberate where one might have expected at least a trace of excited hurry.

After a very authoritative opening to the Schumann Miss Haebler returns to her strict time, almost metronomic style. There are, of course, passages where she relents and adds some very subtle inflections indeed.

It is all deliciously fastidious but, I am tempted to add, as reserved as a box at a Royal Command Performance. The technique remains as immaculate as ever throughout the movement.

Miss Haebler introduces no surprises into the delicious little slow interlude — it is hardly long enough to call a movement. But here I am full of admiration for the way Inbal doesn't overdo the romanticism of the exquisite cello passages and so put them up against the lofty classicism of the pianist.

The last movement is a beautiful example of rhythmic playing.

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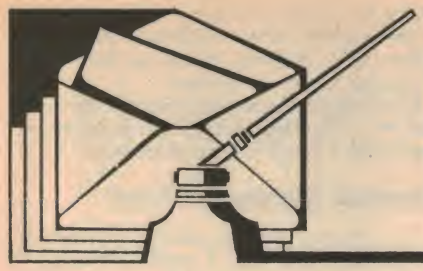

LETTERS TO THE EDITOR

The views expressed by correspondents are their own and are not necessarily endorsed by the editorial staff of "Electronics Australia". The Editor reserves the right to select letters on the basis of their potential interest to readers and to abbreviate their contents where this appears to be appropriate.

Current-limiting supply

In the October issue Ian Pogson describes the useful current-limiting circuit of A.E.T. Nye and a means of adding a facility to drop the output voltage and current to zero under overload conditions.

This facility may be added to Nye's circuit by the much simpler process of adding a diode D3 between the zener point and the output. This normally has a small reverse voltage across it and does not affect the operation of the circuit until current limiting occurs and the load voltage starts to drop. It will then become conducting, diverting current from the zener diode, reducing the load voltage further. At low output current settings, the output is thus boot-strapped down until only the zener current flows through it. At high current settings, a current foldback action occurs, again reducing the output close to zero.

Apart from simplicity, the advantages of this modification are that:
(1) The circuit is not prone to oscillation.
(2) The circuit will boot-strap itself up into the conducting mode again, making it unnecessary to remove the load or the input voltage. (At high current settings the characteristics are completely reversible; at low current settings hysteresis of about 25pc in the load resistance exists).
Dr P. C. Bury,
Physics Department,
Victorian College of Pharmacy.

COMMENT: Dr Bury's alternative modification certainly seems an interesting one, and well worth trying. Ian Pogson is currently doing further work along these lines, the results of which we hope to publish shortly in the form of a constructional project.

Dimmers and RFI

This letter refers to the subject of RFI (Radio Frequency Interference), or as it is sometimes called, EMI (Electro-Magnetic Interference), in connection with your published lamp dimmer designs.

For general speed controls "zero-cross" switching techniques are excellent, with almost complete elimination of RFI. Control and triggering functions for this method are now available in IC form, ie, uA742 (Fairchild), MFC 8070 (Motorola) and CA3059 (RCA).

Zero-cross, however, is not suitable for light dimmers as energy is supplied in bursts. It is my experience that this results in an extreme flashing effect, the rate of which is in accordance with the amount of illumination. The nearer the illumination to full, the greater the flashing rate until it reaches a rate which cannot be detected by the eye.

I now draw upon the article in EA April, 1973. The difficulties of typical commercial light dimmers I have found are just as the article says, the cheaper ones especially. The light dimmer circuit presented in this issue is said to have considerably reduced RFI. The point I wish to raise is what is meant by this? How can the amount of RFI radiated by either the dimmer and / or the power lines be measured?

Surely if a light dimmer producing RFI is installed in a house then the complete wiring of the house will act as an antenna and have an appropriate pattern, etc. If all houses installed such devices then the whole electric grid of a state could become a really giant antenna producing all sorts of problems.

As far as I am aware no standards exist to limit the amount of RFI in light dimmers, speed control etc. I have no idea of how much various state electricity authorities are aware of this problem. Furthermore I do not know what would be a reasonable level of RFI to permit and in what frequency limitations would be put on it,
D. Kiss (East Malvern, Vic).

COMMENT: We know of no accepted standards or recommendations concerning dimmer RFI, either, and we agree that some action in this regard would be very desirable. In view of the difficulty of measuring RFI we have checked our own dimmer designs empirically, ensuring that no significant interference is caused to either hi-fi equipment or a standard radio receiver tuned to local broadcast stations.

Parts for keyboards

In your November 1973 issue of Electronics Australia, page 47 you have an article entitled "Morse Code Keyboard Uses IC's, Novel Encoding System".

Towards the end of the article you refer to the possible difficulty of obtaining the necessary parts in Australia. To assist in this regard we can advise that NS Electronics is able to supply all the IC's listed as well as the 2N2222 and suitable keyswitches from the FR range we represent.
G. Drury,
Manager, Systems Division,
NS Electronics Pty Ltd.
(Bayswater, Vic).

Listening to the World

As a long time reader of your magazine and a DXer for a number of years I wish to express my concern at the dropping of the DX notes "Listening to the World" from the magazine. I have been a reader of, and user of these notes for the last 10 years and have always found them very useful in the pursuit of the DXing hobby.

Could you please reconsider the decision

LETTERS

to drop this page as there surely are many like me who will mourn the passing of the only national coverage of notes for the DXing hobby.

D. E. Porter (Kapunda, SA).

I have just been told that you plan to discontinue the section "Listening to the World".

I am very disappointed that you are going to do this and I know there are many other DXers throughout Australia who agree with me. Many readers including myself only buy Electronics Australia for Arthur Cushen's section.

I thought Electronics Australia was a fine publication catering for many interests but to break it down to Hi-Fi and Projects is disappointing. Since Mr Cushen took over the section in 1952 from Mr Simpson, the section has grown to a very fine production. It was disturbing to see the section cut down to one page from its original 2-3 pages.

You must reconsider your decision. "Listening to the World" is an integral part of Electronics Australia. It separates it from any other Australian electronics publication. Please don't let Electronics Australia become just another tinpot Hi-Fi Magazine.

C. Tyson (Wembley, WA).

COMMENT: These letters are representative of those received since we were forced to discontinue the "Listening to the World" feature, in order to bring the content of the magazine more into line with what readers as a whole seem to want. It was an unhappy decision to make, particularly in view of the many years during which the DX notes were a regular feature. Unfortunately the fact had to be faced that there is a definite limit to the space available in the magazine!

The decision is not necessarily a final one, however. Depending upon circumstances, the feature could yet be reinstated.

Cascode problem — more

Re Letters to the Editor, November, "Cascode Problem." I would refer A. C. Rechner and other readers to "Basic Television" by Grob; "Introduction to Television Servicing" by Swaluw and Van der Woerd (Philips Technical Library); A. W. V. "Radiotronics", April 1953 (Vol 18, No 4); and A. W. V. "Radiotronics", August 1955 (Vol 20, No 8).

Taking all readings together, it would appear that the inductor is the anode load of V1. In conjunction with stray capacitances at each end it forms a broadly tuned circuit.

It is not described in all A.R.R.L. literature as a neutralising inductor; the Handbook for 1955 describes it so, but the Handbook for 1965 says it is for matching impedances between the valves.

J. C. Redman (Wallsend, NSW).

COMMENT: While these references will no doubt prove helpful, we have the impression that the original correspondent was seeking to delve a little further into the analysis. It is still not entirely clear, for example, why the first valve in the cascode pair would need an anode load additional to that provided by the second valve, when presumably the aim is to transfer as much signal as possible into the second valve input. If the coil performs impedance matching, it would be interesting to see its action analysed in detail.

YOU'RE LIVING IN THE HI-FI YEAR 20 A.S.

This is the Hi-Fi Year 20 A.S. *Twenty years AFTER SANSUI. Twenty years* after Sansui successfully introduced a hi-fi amplifier to the world markets. *Twenty years* of Sansui achievement. *Twenty years* of dramatic changes on the hi-fi scene. We've seen the introduction of the stereo recording . . . *and four channel equipment* . . . and Sansui has been there, pioneering research and development for the ever growing international audio market.

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NEWS HIGHLIGHTS

Pioneer 10 Jupiter probe successful

Man's first spacecraft to the planet Jupiter reached the giant planet on December 3, after a 1,000 million-kilometre (620 million-mile) journey that began approximately two years ago. Pioneer 10 approached Jupiter to a distance of 131,400 kilometres (81,000 miles), taking pictures of the brightly-coloured planet and returning physical data that will provide scientists with new information on Jupiter.

Pioneer 10 overcame the first major hurdle of its 21-month mission when it successfully navigated the asteroid belt, the mass of rock and space debris that lies between the orbits of Mars and Jupiter. The spacecraft established that the high-velocity asteroidal particles in the asteroid belt are infrequent, and pose little hazard to outer planetary missions. Pioneer 11, scheduled to encounter Jupiter in ten months' time, entered the asteroid belt last August. It will exit in March.

A few hours before its closest approach to Jupiter, Pioneer 10 returned data on the intense radiation belts that surround the planet. The data indicates that these radiation belts are a million times stronger than Earth's belts and increase in intensity by a factor of 100 for each radius of Jupiter closer to the planet. More importantly, the data received will be used to determine the trajectory of Pioneer 11, and will determine whether Pioneer 11 can safely approach Jupiter to within 32,000 kilometres, close enough to use Jupiter's gravity to make the first trip to the next planet, Saturn.

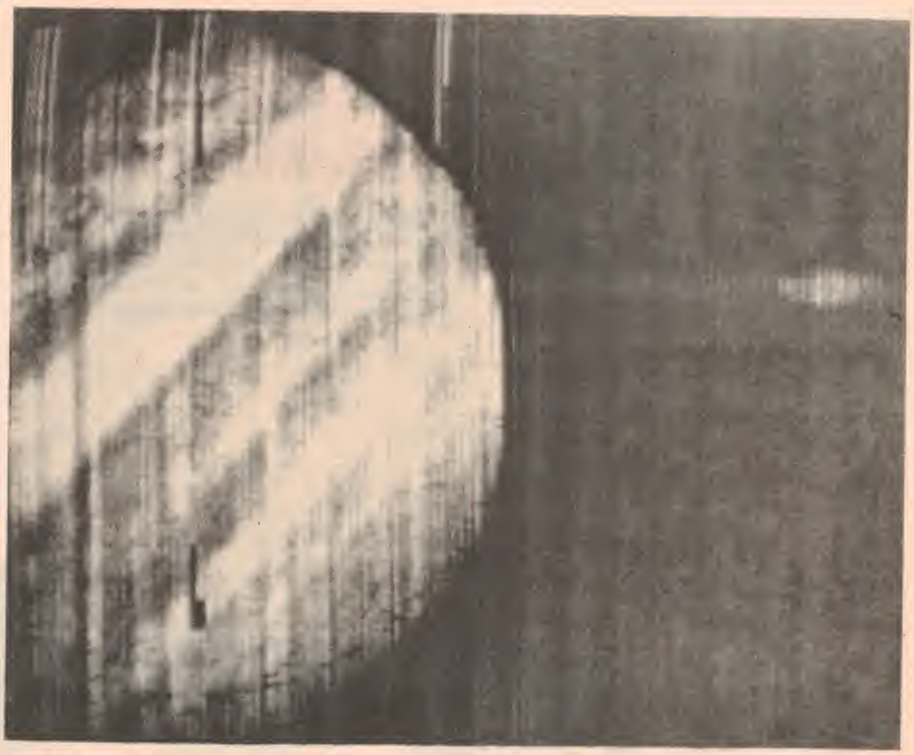
In addition to its findings on the asteroid belt whilst en route to Jupiter, Pioneer 10 has returned a large amount of information on the solar atmosphere. One fact discovered is that, contrary to predictions, the solar atmosphere shields the solar system from cosmic rays at least as far out as Jupiter's orbit.

Spacecraft operations during the Jupiter encounter were complicated by the 92 minutes of round-trip communications time, and the need to send 10,000 commands to the spacecraft in the two weeks centred on the closest approach to Jupiter, the most commands ever handled by the Deep Space Network. Operational strategy was to set most of the spacecraft's systems in one standard mode throughout encounter, with most of the commands going to the spacecraft's imaging system.

Data returned by Pioneer 10 during the encounter period with Jupiter includes:

- information on the mass and orbits of many of Jupiter's moons;
- low resolution pictures of the four large inner moons;
- temperature measurements; and
- information on the surface characteristics of the four large inner moons.

A prime objective of the spacecraft was to search for evidence of an ionosphere and an atmosphere on Jupiter's second closest moon, Io, the most reflective object in the solar system. In addition, Pioneer 10 measured the total mass of Jupiter, determined the amount of polar flattening to within one-half mile, and returned magnetic field data which will be used to calculate the fluid composition and structure of Jupiter's interior.



This picture of the planet Jupiter, with one of its moons (right), was recorded by the Pioneer 10 spacecraft approximately 20 hours before its closest approach to Jupiter. The photograph has suffered considerable degradation during the wirephoto process.

The Pioneer 10 mission has set an array of records. These are as follows:

- Pioneer 10 has travelled farther and faster than any other man-made object. Its launch speed of 51,704 km / hr (32,114 mph), a record in itself was surpassed by its speed at closest approach to Jupiter of 132,000 km / hr (82,000 mph);
- it has communicated many times farther than any other communications system, and may maintain communications from as far out as Uranus' orbit, almost two thousand million miles away;
- it was the first spacecraft to fly beyond Mars' orbit, first to cross the asteroid belt, and will become the first man-made object to excape the solar system; and
- it is the first NASA spacecraft to exclusively use nuclear power.

Pioneer 10 weighs 260 kilograms (570 pounds) and is spin stabilised, providing its instruments with a full circle scan of five times per minute. It uses nuclear sources for electric power, as sunlight is too weak in the Jupiter region for an effective solar powered system. The spacecraft has a 2.75 metre dish antenna which pointed back towards earth through the mission, and adjusted its view by changes in spacecraft attitude as the home planet moved in its orbit around the Sun.

Teamed with the spacecraft were the three incredibly sensitive "big dish" antennas of NASA's Deep Space Network, which retrieved the data transmitted by Pioneer 10. Pioneer's 8 watt radio signal from Jupiter reached these antennas with a power of 1 / 100,000,000,000,000,000 watt. Collected and stored for 19 million years (if, in fact, this could be done) this energy would light a 7.5 watt Christmas tree bulb for only 1 / 1,000 of a second.

Pioneer 10 is now heading out of the Solar System. It will cross Saturn's orbit in 1976, Uranus' orbit in 1979, Neptune's orbit in 1983, and in 1987, 15 years after its launch, the orbit of Pluto, the boundary of the Solar System. Pioneer's destination among the stars will then be somewhere in the Constellation Taurus. The spacecraft carries a plaque which is intended to inform any intelligent beings who may find the spacecraft, perhaps in millions of years from now, exactly where the spacecraft came from, and who sent it.

Shipborne satellite communciations

The first of the revolutionary SCOT shipborne satellite communications systems has been handed over to the Royal Navy by the manufacturers, Marconi Space and Defence Systems Ltd.

This is the first of eight systems, worth a total of more than £1m, which were ordered in 1971, when a pre-production system was extensively tested under operational conditions at sea. The order is due to be completed next year, and will meet the future long-haul communications requirements of the Royal Navy via the British Skynet satellite communications network.

The SCOT system is a self-contained unit which is small enough to be mounted on all ships down to Frigate size. The system uses a pair of 1.1 metre diameter dish aerials, constructed from a fibre reinforced plastic, with a metal coated reflecting surface. These two aerials are mounted on either side of the ship, such that at least one dish will have line-of-sight contact with a satellite in any part of the sky at all times. Each dish is fully steerable, and is mounted on a three axis mounting designed to cater for the ship's motion in heavy seas, and to ensure that full steerability is maintained at all attitudes.

The satellite terminals will be fitted in all Royal Navy ships down to Frigate size, and can be transferred without difficulty between suitably equipped ships. Installation of the SCOT systems will be carried out by naval dockyards, and will be phased to allow RN ships to operate into the Skynet II satelites, which are also being designed and built by Marconi Space and Defence Systems Ltd.

Multi-colour 3D image Video package

The Central Research Laboratory of Hitachi Ltd has developed a method for storing multi-colour three-dimensional images in high density storage holograms. The method is a result of new advances made in technology developed earlier by Hitachi for a high density digital laser holographic memory.

Basically, the holographic memory consists of laser beam memory elements that are used to record information in a storage medium as interference fringe patterns. High density storage of multi-colour, three dimensional images is made on 35mm film. An experimental model of the three dimensional image video package has been produced, and was displayed at the Hitachi Technical Exhibition held at the Science Museum in Tokyo last October.

The main features of the new Hitachi system are: high density storage capability of multi-colour three-dimensional images, the device is compact, a broad view may be obtained of good quality images, and images can be moved or switched simply by manipulating the film. Hitachi claim that the new method is particularly suitable for three-dimensional colour displays of advertising, educational, and medical material. In addition, the company claims that further development of the techniques involved will make possible three-dimensional moving pictures and three-dimensional colour television programs.

Europe to manufacture "Spacelab"

An unprecedented new international co-operative project is provided for in a Memorandum of Understanding recently signed in Washington by Dr James C. Fletcher, NASA Administrator, and Dr Alexander Hocker, Director General of the European Space Research Organisation (ESRO).

Nine European countries, through ESRO, will design, develop, manufacture and deliver a "Spacelab" flight unit which will be an important element of NASA's Space Shuttle program. The Spacelab will be carried in the Space Shuttle Orbiter which will look like a delta-winged airplane about the size of a large jet liner. The Spacelab will have two important elements: a pressurised manned laboratory module which will permit engineers and scientists to work in a normal shirt-sleeve environment; and an instrument platform, or pallet, to support telescopes, antennae, and other equipment requiring direct space exposure.

The NASA / ESRO agreement represents a major step in the sharing of space costs between the US and European countries participating in this co-operative project. The estimated cost of $300-400 million for the Spacelab will be borne by ESRO.

The nine European countries involved in the Spacelab program included: Belgium, France, Germany, Italy, The Netherlands, Spain, Switzerland and the United Kingdom.

The first operational Shuttle space flight is scheduled to take place in late 1979.

Superconducting magnet suspends train

A prototype of a wing-type superconducting magnet capable of magnetically suspending a 500km / h (300 mph) super-high speed train has been completed by the Tokyo Shibaura Electric Co (Toshiba).

The device has been test-manufactured by Toshiba in accordance with the Japan National Railway Corporation's plan to run a 500km / h super-high-speed train between Tokyo and Osaka, Japan's two biggest cities (located some 500km apart), in the 1980s.

The new superconducting electromagnet is only 24 cm thick, thus enabling it to be fitted beneath the body of a train in a manner similar to the wings on an aircraft. The magnet is inserted into hollow-type ground coils which correspond to the rails for a conventional train. Known as the "Null Flux" track, this system offers little electromagnetic resistance, even when the train is travelling at high speeds.

In completing the prototype, Toshiba has solved several technical and economic problems associated with the practical operation of electromagnetically driven high-speed trains. One of the problems is that while the lift power is generated between the train's magnet and the ground magnet, an electromagnetic resistance is generated which opposes the force propelling the train. The Null Flux track system minimises this electromagnetic resistance, making operation of the train on relatively small power quantities feasible. Moreover, the wing shape of the magnet reduces air resistance and lends stability to the train whilst it is in motion.

Real-time medical diagnosis for Perth hospitals

Two Perth Hospitals will soon have the most extensive on-line real-time computing systems for medical use in Australia. The Sir Charles Gairdner Hospital and the Royal Perth Hospital will each install a Digital Equipment PDP-11 / 40 computer, following the recommendations of a joint committee established by the two hospitals.

In each hospital, the computing facilities will be developed and administered independently by the respective departments of medical physics in co-operation with the WA Government Medical Department, and will be used for clinical and research work in the fields of nuclear medicine and lung physiology.

Storage capacity of the system at the Sir Charles Gairdner Hospital will be 40k whilst the Royal Perth Hospital system will have a 32k word core storage capacity. Both installations will use the Digital Equipment RSX-11D real-time operating system and will have RK05 disc drives, paper tape readers and punches, and storage CRT displays.

Dr J. Black, chief medical physicist at the Sir Charles Gairdner Hospital, and Dr M. Quinlan, nuclear medicine physician, plan to provide on-line data acquisition for a number of diagnostic procedures using radioactive tracers. These include radioactive iodine uptake measurements of the thyroid gland, renogram measurements used in assessing kidney function, and red blood cell lifetime determinations. Beyond the field of nuclear medicine, the computer will also be used by Dr K. Finucane, hospital pulmonary physiologist, for measuring absolute lung volume, diffusing capacity, airway closure and ventilatory ability, and for many complex predictive computations for lung function testing.

A comprehensive range of **Moririca photoconductive cells and devices** designed for a multitude of applications are readily available. The range includes cadmium sulphide and cadmium selenide types together with a variety of photocell lamp modules and sophisticated resistive and sensing devices as outlined below. These cells feature high sensitivity, fidelity and power dissipation coupled with fast spectral response inclined more towards infra-red than visibility. Contactless, non-mechanical construction of photocell lamp modules completely eliminates noise and mechanical wear so that a lengthy, silent operating life is ensured.

Moririca **high power photocells** find application in card reading, automatic weighing and paper money exchanging machines . . . also auto-stop devices, photoelectric relays, alarm devices, floating indicator lamps, road beacons and automatic light switches. **High sensitivity cells** are to be found in camera electric eye mechanisms, photoelectric type toys and the like whilst **photocell-lamp modules** are suited for use in non-contact switches, vibration circuits, delayed relays, protective circuits, etc. The Moririca range has almost unlimited application in today's Professional equipment technology.

Photentiomatic (photo-potentiometer). Functions as a potentiometer controlled by light in which output voltage changes according to shifting a slit of admitting light.

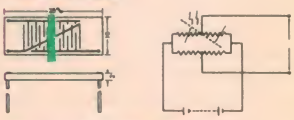
No mechanical contact construction results in quiet, long-life operation. It offers excellent resolution and high convertible ratio from input to output voltage.

Photobridge (displacement detector for servo mechanisms). Designed for use in displacement detector circuitry in which element resistance is controlled by the relative position of a light admitting slit. Amongst its features are simple adjustment of the light beam and setting point, minimal effect from temperature and light level differences, extended service life and no mechanical noise.

Selenium photovoltaic cells are also available in disc or rectangular form. They are of humidity proofed construction, withstand mechanical vibration and are shortcircuit resistant. Typical applications include use in light meters and colour meters.

Photentiomatic

Photobridge



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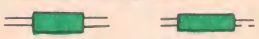

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NEWS HIGHLIGHTS

Computerised defect monitoring system

Installation of the new computerised defect monitoring system, which transmits data to areas of responsibility via television receivers, has been completed at American Motors' main plant in Kenosha, Wisconsin, USA.

The computerised communications network consists of large television receivers placed in strategic plant locations to keep workers informed of quality levels throughout assembly operations.

George A. Maddox, manufacturing manager for AMC passenger cars, said quality information is flashed to 50 television receivers in key areas to provide managers, foremen and hourly workers alike with a rundown on quality status in individual body trim and final assembly areas. In addition, plant management can request information on individual defects at any time, and get a reply via a television receiver in a matter of seconds.

The new system is much faster than the previous method of sending reports by printer to data processing and then waiting for the return transmission of defect figures over the same printer. It enables management to find out almost instantly how any department in the body or assembly plant is functioning from a quality standpoint. In addition, the overall quality on a collective level may be easily gauged.

A total of more than 7,000 defects which could occur during the trimming and final assembly of a car have been coded and stored at the Kenosha main plant systems and data processing centre. Inspection reports are collected at four locations and transmitted to a computer for processing and analysis. A mini-computer is then instructed to transmit the quality data back to the appropriate plant area.

Each of the 23 inch colour television sets receives, at intervals of six minutes, the six top defects in its specific area during the previous half hour, then for the particular work shift, and finally, any "red line" safety defects reported.

The TV receiver spells out the defects, gives numerical and percentage totals and, by code, lists the foreman with primary responsibility. There is provision for listing up to three additional foremen with secondary responsibility. Data remains on each of the TV receivers for periods of two minutes in each of the three categories.

By mounting the television receivers in overhead cradles, quality information is readily available to all employees in any work area. — George E. Toles.

Electronics and sex defeat mosquito

The latest weapon in man's struggle with nature is the Skeeter Skat, an electronic weapon designed to combat one of man's smaller enemies — the mosquito.

The Skeeter Skat, which is about the size of a cigarette packet, emits a high frequency sound which attracts the male mosquito and repels the female. The sound emitted by the unit is almost inaudible to human ears.

Once the female has mated, she needs blood before each incubation can take place. During this period, the female will avoid any contact with the male. The female, therefore, not only dislikes the Skeeter Skat sound, but is also repelled by the "safe" males which are attracted to it.

Electronic "super-nurse"

An electronic "super nurse" that watches over the needs of patients, and by so doing eases the work load on skilled staff, is now being marketed in Australia by Standard Telephones and Cables Pty Limited, Sydney. The "super nurse" is the Teletracer K7 which is already in widespread use in British, American and European hospitals.

The Teletracer K7 makes conventional floor and ward nurse stations obsolete by centralising patients' calls to a central console capable of handling up to 600 beds with a single operator. A patient requiring attention from one of the nursing staff simply presses a button and speaks into the beside unit to make his request to the central control. The console operator acknowledges the call and, if necessary, contacts the nearest nurse by a pocket paging system, thus enabling the patient's request to be dealt with quickly and efficiently.

This is in sharp contrast to the standard system operating in most Australian hospitals whereby the nurse on the ward station is alerted by means of a buzzer or a light. The nurse then has to leave the station to enquire the caller's needs, carry out the required task and then return to the station so that other calls may be answered.

As well as operating as a patient-nurse call system, the Teletracer K7 unit offers the patient the choice of four radio programmes and TV. In hospitals where the system has been installed, patient calls have been reduced by as much as 40 percent. These same hospitals have also reported an increase in nursing efficiency, together with a marked reduction in staff problems. In addition, the system may be used to connect every area in the hospital so that the overall efficiency of the hospital may be increased.

Ionospheric "photographs"

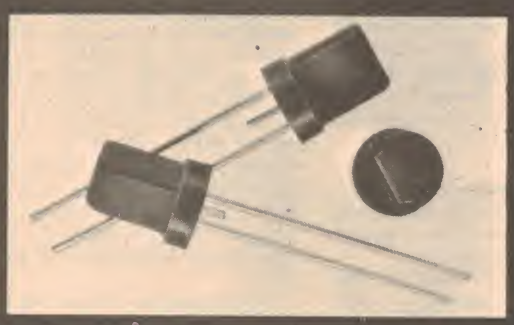
An Australian physicist, Dr Basil H. Briggs, Reader in Physics at the University of Adelaide, has devised what he believes may be the most advanced system yet developed for "photographing" the ionosphere.

It has, of course, been known for many years that the reason shortwave broadcasts tend to vary in clarity and intensity is because of irregularities in the ionosphere, a band of charged particles some 400km thick ringing the earth from a height of about 100km. Shortwave broadcasts are made by reflecting radio waves back off the ionosphere. When the transmitted signal hits a bump in the ionosphere, the signal may be wildly deflected and/or a higher degree of absorbtion of the signal may take place.

The apparatus developed by Dr Briggs has shown that these irregularities are in fact moving wavetrains with a wavelength of about 20km. Armed with this knowledge, Dr Briggs believes that radio engineers may be able to develop more effective transmission equipment. He also believes that since the speed of the ionospheric undulations in the lower part of the ionosphere equals the speed of the wind in these regions, this information will provide valuable data for meteorologists.

GE DESIGNED THESE TRIACS FOR YOU

GE originated the triac in 1963 and now offers new standards of performance and reliability. Silicone encapsulated SC141 and SC146 triacs, up to 500 volts, and 6 and 10 amps respectively, feature the new proprietary ***POWER-GLAS***™ passivation process which creates a void free bond between the silicon chip and the matched glass. This results in low "off-state" currents of typically 10 μA. The SC141 and SC146, like all GE triacs, have inherent immunity from transient voltage damage and improved commutating dv/dt. Additionally these rugged packages incorporate a stress-free assembly system, which offers you torque limit-free tab mounting and easily formed round leads. For your convenience, GE offers 6 standard lead configurations. These features make the SC141 and SC146 your best value in 6 and 10 amp triacs.



Another GE creative design, the ST4 asymmetrical trigger, is an ideal trigger for light dimmer applications. It features performance comparable to triggering circuits using at least 3 additional passive components and greatly reduces hysteresis effects by means of a single RC time constant. It is truly an economical companion to GE ***POWER-GLAS***™ passivated triacs.

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NEWS

Japanese drive on Australian FM market

The Pioneer Corporation of Japan will attempt to gain a large slice of the Australian FM radio market when FM transmission begins in this country.

Mr Shigeru Hayakawa, Pioneer's international managing director, recently announced that the anticipated problems of the Australian market would be met and overcome by his company. Australia seems likely to adopt FM radio on the UHF range, as opposed to the more common VHF frequency range adopted by overseas countries. This situation has previously led to conjecture as to whether or not major overseas manufacturers of hi-fi equipment would be prepared to manufacture receivers especially for the Australian market.

Speaking at a press conference to announce the establishment of a local Pioneer company (to handle distribution and marketing of Pioneer's products in Australia), Mr Hayakawa said: "Although a decision has not yet been made, if the Australian system proves to be incompatible with the receivers manufactured in Japan, some solution will be found. A possible solution will be to fit a simple adapter to the present range of Pioneer receivers."

The new Pioneer company is to be called Pioneer Electronics Australia Pty Ltd, and will be 100 per cent owned by the Japanese parent company. The company will be under Australian management.

High efficiency charge transfer IC

Philips Research Laboratories in Eindhoven, The Netherlands, have developed a much improved charge coupled device (CCD). Designated the "peristalic charge coupled device" (PCCD), this device is capable of charge transfer from input to output with much greater perfection and at a far higher speed than previous devices.

The improved IC is based on the fact that the speed at which the charge is transferred from a given storage capacitor to the next is largely determined by the transport of the last fraction of the charge to be transferred. The PCCD is so designed that this last fraction is stored further away from the electrode of the storage capacitors than for a conventional CCD; that is, more inside the semiconductor. The greater part of the charge is stored in the vicinity of the electrode (as in conventional CCD's), which means that a low switching voltage suffices to ensure charge transfer.

As the last charge fractions are farther from the electrodes, they can be subjected to external drive fields, enabling the charge to be rapidly transferred to the neighbouring element. In addition, the mobility of charge carriers inside the semiconductor is greater than it is close to the surface, which also contributes to the increased charge transfer speed. An experimental PCCD device has been developed in which a transfer efficiency of more than 99.99 per cent, at transport rates better than 100MHz, have been measured.

Computer guides artificial limb

A miniature computer, which guides an artifical limb to allow handicapped persons to perform basic tasks, has been developed by two researchers at the Stanford Research Institute (SRI) in Menlo Park.

The two, John Hill and Anthony Sword, believe that an artificial arm, allowing a handicapped person to perform tasks such as feeding himself and reaching into his pocket, could be built for about $2,000.

In addition, the two researchers estimate that a system capable of performing such hard-to-automate operations as tying one's shoe laces could be developed within five years, and sold profitably for about $3,500.

Their research into computer-guided artificial limbs is an offshoot of work on a special arm developed for the National Aeronautics and Space Administration to be used for remote-control space operations.

One problem with artificial limbs is controlling several motors or joints at once in order to simulate the complex movements performed by the human arm, Hill said. The SRI-devised system works by using the mini-computer to translate a single signal from the user of the artificial limb into the more complex series of signals controlling the motor of the limb itself.

In the laboratory system the user of the arm signals a movement by teletype. But in a working model the user might signal the computer by shrugging his shoulders in a sequence of slow or fast movements similar to the dots and dashes of Morse Code.

Hill said that each amputee is a special case with special needs. Thus, the two men are investigating several different minicomputer programs, each of which would provide a variety of motions to suit the circumstances of the user.

Glass fibres made by laser

Shown at right, a Bell Labs' scientist uses a powerful laser beam to melt a glass rod so that it can be drawn into a hair-thin fibre about one mile long.

The potential future use of glass fibre is for transmitting light beams carrying vast amounts of telephone messages, business data, and computer information.

The fibre making system, designed by Ray Jaeger and Walter Logan at Bell Laboratories, uses a carbon dioxide laser as a highly controllable and "clean" source of heat in place of conventional heaters which put minute impurities in the glass.

Studies of experimental laser techniques for making glass fibre is a current research program at Bell Laboratories.

Big orders for colour TV equipment

Amalgamated Wireless (Australasia) Ltd, acting on behalf of Marconi Communication Systems Limited, has won a large share of the first wave of orders placed by Australian broadcasting companies for colour television equipment. The orders were won against European, Japanese, and North American competition, and follow comprehensive demonstrations of the equipment to Australian engineers, both in Australia and at the company's headquarters in Chelmsford.

Orders received to date call for Marconi to supply equipment worth over $A4 million, including more than 40 Mark VIII automatic colour cameras, three outside broadcast vehicles, two of the new advanced integral telecine units, monosync pulse distribution equipment, synchronising pulse generating equipment, and vision distribution and line clamp amplifiers.

One of the three outside broadcast vehicles included in the orders has already been delivered to the Australian Broadcasting Commission in Sydney. The vehicle, the first of its type in Australia, has four Mark VIII colour camera channels and was built to stringent ABC specifications. The second vehicle, also equipped with four Mark VIII camera channels, was scheduled for delivery at the end of 1973 to ATN 7 in Sydney, while the third vehicle, with five Mark VIII camera channels, will be delivered early this year to HSV 7 in Melbourne.

Mark VIII cameras for studio use have also been ordered by ATN 7 (seven), HSV 7 (seven), Channel Ten United Telecasters in Sydney (seven), BTQ 7 in Brisbane (two), and BCV 8 Bendigo (two). The Video Tape Corporation, Sydney, a company producing advertising commercials, has ordered two Mark VIII's which will be used in an outside broadcast unit to be supplied locally, together with a Marconi B3402 colour telecine unit.

Cable TV: the long awaited dream—part 3

One of the most interesting innovations of cable TV in the United States is the ruling by the Federal Communications Commission (FCC) requiring cable operators to provide channels for public access. In this, the third of four articles, the author examines the various aspects of public access TV and discusses the problems facing those groups wishing to produce suitable program material.

by LES RICH

The ballgame is rained out; he's seen the old movie; he can't stand quiz shows. What's the constant viewer to do, that Saturday afternoon, as the pop-tops collect in the ashtray?

He'll probably wear out his tuner, for one thing, in his restless search for something interesting. But if he's a New York cable TV subscriber, he just might flick past what he considers the dead channels, say C and D, and he might just stop. And he'll wonder if what he sees is real.

He might see a Gay Liberation march on Christopher Street. He might see a man taking a bath (naked, naturally). He might also see reasonably sensuous girl dancers, also nude. Or, if he's luckier, the constant viewer could be treated to one of the striking, and reasonably respectable, programs that are presented from time-to-time on public access television along with the "junk."

Last year, for instance, there was the spectacle of the tubby gentleman jogging through Little Italy with an Olympic torch made out of a can of Sterno. As an announcer described the scene from "High atop the fire escape on Thompson Street," the torch bearer made a determined effort to get the flame transferred to some smaller torches made out of beer cans. Sponsored by a fun-loving beer company, the "Street Olympics" featured hilarious "showdowns" in stickball (the torch-bearer was a "three-sewer man," meaning he could hit the ball past three manholes), stoopball, and Johnny-on-the-pony. Although this even got a minute or two on the local news at the time, it was covered for hour-after-hilarious hour on public access TV by Open Channel Inc., acting on behalf of the city Department of Recreation.

During the course of its two year existence, Open Channel has been instrumental in the airing of some valuable programs. An organisation called "Alliance for a Safe New York," for instance, presented an ex-prostitute to give her views on "victimless crimes," and reported that a well publicised clean-up of 42nd Street had only resulted in the offenders moving to 52nd Street. A community newspaper called "Inwood Advocate" went on air with its campaign to get the National Guard to clean up dead trees in the parks "instead of hanging around the post looking at old movies on veneral disease." The US Bicycle Polo Association demonstrated its own particular form of mayhem, and the New York Public Theatre was shown in a Central Park concert by a group headed by Felipe Luciano, founder of the Young Lords, the Puerto Rican youth activist organisation.

One of the most noteworthy of Open Channel's efforts involved the black evangelist, Maria Graham, holding forth amid rings of firmly clasped hands in Brooklyn's Institutional Church of God and Christ.

Theadora Sklover, ex-schoolteacher, ex-dancer, now something of a celebrity at 34, is the creator of Open Channel. And it was her lobbying, as much as anything else, that brought about the FCC ruling that all cable operators must provide public access channels. But, Theadora, who is now Open Channel's executive director, is quick to say that the real guts of her organisation is represented by the 200 odd film and TV professionals who form its talent pool. These people stand ready to donate their spare time to getting the public access shows on air.

Included in the Open Channel talent pool are some very prominent people in the movie and TV industry, such as Gerald Cotts, an independent film maker and director of photography for the movie "Putney Swope"; Ivan Cury, an award-winning movie director; Mark Dichter, acoustical engineer for the movie "The French Connection"; Lou Potter, a producer and writer; Howard Weinberg, Emmy award-winning documentary maker; and many others.

Open Channel's services are free, and are financed out of its foundation grants. "It's not enough to tell people they have free access" says Theodora Sklover. "You also have to help them make programs." And there's a wide diversity in the type of assistance Open Channel is asked to provide. Some groups want the professionals to do everything, whilst others just want help and advice.

In recent months, Open Channel has become involved with groups of schoolchildren who are interested in CATV as an educational tool. Open Channel is at present training both students and teachers in the productive use of television, and this often results in the development of new programs which are then aired over the public access channels. For example, students from Harlem's Haaren High School were recently observed scurrying around the city, interviewing mayoral candidates. Althouth the tapes were sub-

Mission Cable Two's "School Zone" lets the children do the talking about their school's activities.

sequently shown on one of the public access channels, the primary aim of the whole project was to demonstrate the election process to the students. One result of the project was that the students started watching regular TV news programs to see if the news interviews were as good as those on the public access channels.

At an elementary school, PS 145, Open Channel's Natalie Robbins heads up a project in which the students have taped scenes of the school, the street, the stores, and various other scenes to illustrate their own poems, which have names such as "Prejudice," "Elevators," and "Why Blues." Another Open Channel employee, Jeff Strickler, trains the children in the use of TV equipment.

Open Channel isn't the only group making thoughtful contributions to public access TV, nor is New York the only city where public access TV had made a start. Other groups include Community Action Newsreel, which reports on New York's Lower East life in English, Spanish and Chinese, and the Alternate Media Center at New York University, which also offers technical assistance and training.

In Santa Monica, California, the president of the PTA recently put the meeting on public access TV so that non-attending members could view the proceedings. Other public access TV is being shown in cities such as Charlestown, Cape May, Wildwood and Berkeley.

In order to obtain a showing on one of the public access channels, all one generally has to do is fill out an application form and submit the tape. In New York, Telepromter maintains a storefront studio in Harlem where videotape equipment can be used free of charge. However, the more common practice is for the interested group to somehow produce its own program, whether through an organisation like Open Channel or Alternate Media, or by scrounging up the $75 daily rental for a Sony Portapak, which includes a camera, a battery-powered half-inch tape deck, a microphone, and various other pieces.

Money remains the major problem for most groups interested in producing their own programs. Open Channel points out that to make a show with production values good enough to attract any sort of audience would require three Portapak systems, along with lights, a sound system, and other associated equipment. The cost of such equipment would be in the vicinity of $25,000.

This still calls for the use of half-inch tape, which, in its present state of development, presents a rather poor image. Open Channel recommends the use of one-inch tape for editing purposes and for the more important scenes. The general use of one-inch tape is prohibited by the high cost of the equipment, and, to some extent, by the cost of the tape.

"Public access needs money if it's to be a real extension of the First Amendment," says Theadora Sklover. "When the FCC said that operators had to set aside channels for the public, the municipality and for education, it was like saying: 'Here are three roads, but don't ask how you're going to pave them, who gets the cars and who handles the traffic'."

Ms Sklover stoutly opposes any suggestion that groups appearing on public access cable programs should be charged for the cost of producing their shows. And she insists that, to succeed, free access must be open to all shades of opinion, however far out. "We're not here to editorialise or make dicisions about what people can say over the air," she declares. "If the Nazi Party walked in, I'd have to give them time. I wouldn't like it, but that's what public access is all about."

Open Channel has had some success with foundation grants, although, in Ms Sklover's opinion, these are insufficient for continued long-term operation. Instead, she believes that public access TV must be placed on a secure long-term financial basis by imposing slightly higher licensing fees on cable operators, with the city setting aside the excess for the public channels.

Meanwhile, spurred on by some of the sensationalism, more and more people are becoming interested in public access TV. One Anton Perich, a sort of latterday Andy Warhol, has attracted a following (of sorts) in New York with his rather birdlike explorations of subjects such as the sex life of queens. Another group named the "Raindance Corporation" has published a book entitled "Guerilla Television," advising the so-called counter-culture on how to claim its TV rights. And one recent evening an East Side bartender was heard to say to an amazed customer: "I saw a naked lady on TV last night . . . honest!"

The CATV scene in Australia

Prompted by our current series on cable TV, EMI (Australia) Ltd have sent details of the local market.

The company demonstrated its range of CATV equipment at a recent IREE conference in Melbourne. This equipment is now being assessed by the PMG Research Laboratories, and EMI are hopeful that their equipment will be used as the basis of a VHF broadband system in addition to a single channel system.

Several CATV systems are already in operation in Australia. A consortium of some 50 residents, known as the "Management Committee" operate a CATV system in Bayview, Sydney; Channelmaster, a division of O'Donnell Griffin, has 10 homes linked into a CATV system at Castlecrag (Sydney), whilst at Balmoral (Sydney), 104 homes are linked to a common CATV system.

The EMI RE988 Trunk / Bridger amplifier is intended for use in subscriber areas.

"Microwave's" Wayne Runyon goes on camera for Open Channel at the Lincoln Centre Community Street Festival.

School children feature in a Reston cablecast "The Treasure Chest", produced by Warner Cable.

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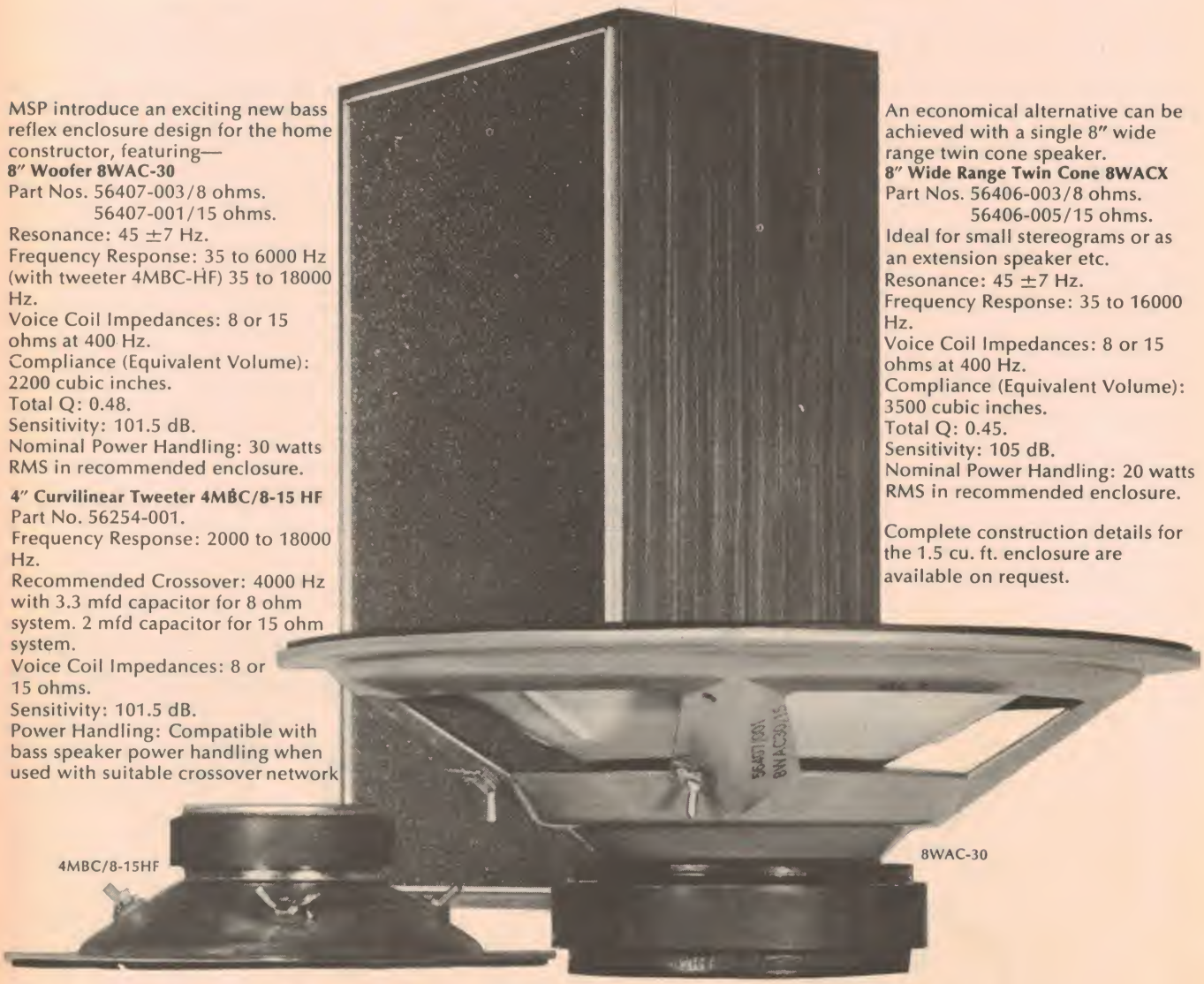
56407-001/15 ohms.
Resonance: 45 ±7 Hz.
Frequency Response: 35 to 6000 Hz (with tweeter 4MBC-HF) 35 to 18000 Hz.
Voice Coil Impedances: 8 or 15 ohms at 400 Hz.
Compliance (Equivalent Volume): 2200 cubic inches.
Total Q: 0.48.
Sensitivity: 101.5 dB.
Nominal Power Handling: 30 watts RMS in recommended enclosure.

4" Curvilinear Tweeter 4MBC/8-15 HF
Part No. 56254-001.
Frequency Response: 2000 to 18000 Hz.
Recommended Crossover: 4000 Hz with 3.3 mfd capacitor for 8 ohm system. 2 mfd capacitor for 15 ohm system.
Voice Coil Impedances: 8 or 15 ohms.
Sensitivity: 101.5 dB.
Power Handling: Compatible with bass speaker power handling when used with suitable crossover network



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Part Nos. 56406-003/8 ohms.
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Ideal for small stereograms or as an extension speaker etc.
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A.D. 30

The Plumbicon tube — ten years of success

Introduced in 1963, the Plumbicon television camera tube has played an important role in the development of colour television facilities. This short article reviews the ten year success story of the tube.

Introduced into the United States in 1963, the Plumbicon tube attracted immediate attention from camera manufacturers, so much so that, during the initial stages, production could hardly keep pace with the demand. In addition, the new tube won several international design awards. Included in these were the Society of Motion Picture and Television Engineers' David Sarnoff gold medal and the US National Academy of Television Arts and Sciences' Emmy Award.

Today, ten years after its introduction, the Plumbicon camera tube is being used in nearly every TV studio in the world. They are found not only in broadcasting corporations' cameras, but also in black-and-white and colour cameras of closed circuit TV systems used, among other things, for industrial and medical applications.

The Plumbicon camera tube has several inherent advantages when compared to the image orthicon and the vidicon camera tubes. It combines the high speed characteristics of the image orthicon with the small size and simplicity of adjustment of the vidicon. In addition, the Plumbicon possesses extremely good linear sensitivity characteristics.

The speed of a camera tube refers to the ability of the tube to react to changes in light intensity. A high speed tube is therefore capable of producing sharp images of moving objects, whereas a "slow" tube will produce blurred outlines of moving objects. The higher speed of the Plumbicon tube, as opposed to the vidicon tube, is one of its main advantages.

As mentioned above, the Plumbicon tube possesses good linear sensitivity characteristics. This means that the signal output from the tube is directly proportional to the light intensity of the scene being recorded. This condition is a pre-requisite for good colour television. The Plumbicon tube is thus ideally suited to colour television cameras.

Many different types of Plumbicon tubes are being manufactured, each with its own specific application possibilities. The success of the Plumbicon tube is based on the composition of the light-sensitive target layer, in which lead-oxide plays an important role. During the 1950s, many companies worked on "lead oxide vidicon tubes," but with only a limited amount of success. Philips research scientists were the first to overcome the problems encountered and produce a camera tube, based on lead oxide, which met the stringent requirements of the television industry.

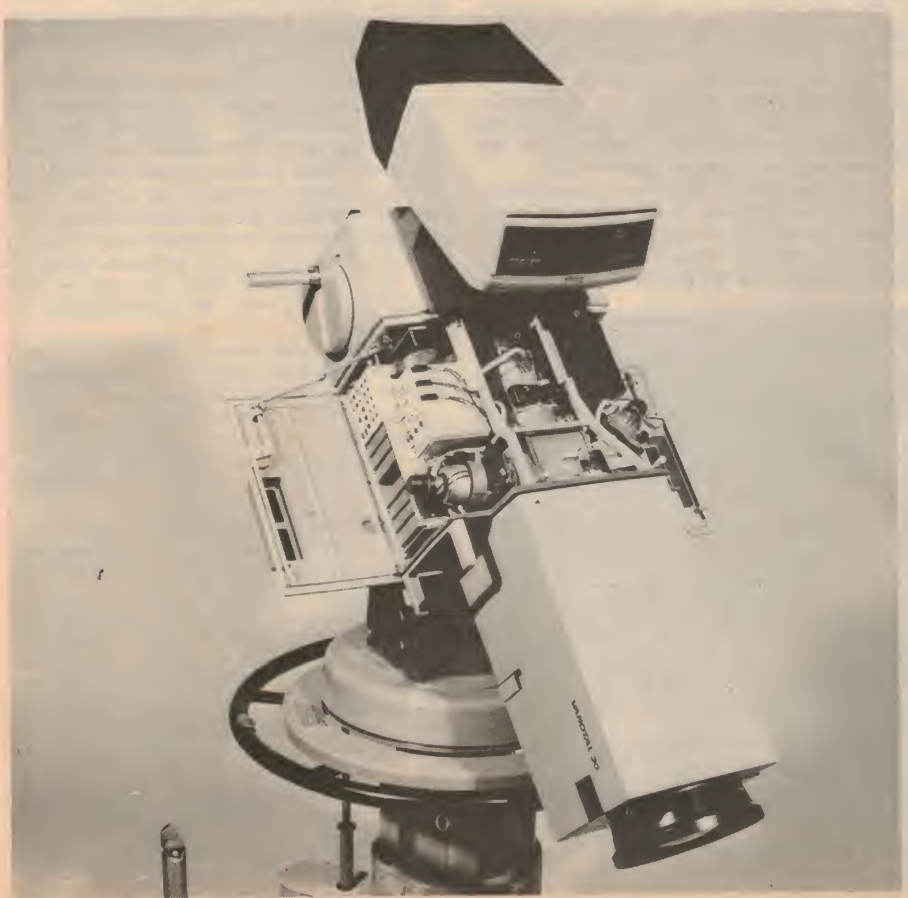
The application of the light sensitive layer to the Plumbicon tube demands special manufacturing techniques, expensive equipment, and well trained staff. At present, there are only three factories throughout the world where these tubes are being manufactured: one in Eindhoven, another in Slatersville, USA, where the tubes are manufactured under licence by the Amperex Electronic Corporation, and a third in Osaka, Japan, where they are produced by the Matsushita Electronic Corporation, also under licence.

The Plumbicon tube marketed in 1963 had a diameter of 30mm, and soon became the standard tube for studio colour television cameras. The 25mm and 16mm tubes were released in 1968. Continued research and improvements in the layer technique has resulted in the 25mm tube, which is interchangeable with the vidicon tube in existing cameras, having the same resolving power as the 30mm tube.

The 25mm tube was initially intended for use in industrial and closed circuit TV, and it soon became fully accepted for these applications. In its early stages, closed circuit television was used primarily for observing industrial processes. As colour is often an essential component in the transmission of information, this field of application was extended considerably when colour television became economically viable. These systems are now being used by universities for medical training and by trade and industry for business and service training. Instruction and training programmes are generally recorded on video tapes or cassettes by the users themselves , and and this requires the use of compact, easy-to-handle equipment.

The 25mm tube has also proved to be attractive for use in broadcasting studios because it enables the use of smaller cameras without loss of picture quality. There are indications that the 25mm tube will become the standard tube for studio cameras. Philips are already fitting it to the latest LDK5 colour studio camera.

(Courtesy Philips News.)



A modern colour camera using three Plumbicon tubes.

Electronics in tomorrow's cars—part 2

Research and development of electronic technology for the automobile industry is gathering increasing momentum and, already, there are signs that electronics may "rob" the motorist of his most prized possession — the freedom to control his own vehicle. In this, the final article of our two part series, the author examines some of the more radical motoring innovations that are planned for future vehicles.

by COLIN MAITLAND

Motor vehicle developments and improvements are rarely prompted by government pressure. Public clamour for greater comfort and convenience, together with the racing fraternity's search for increased performance and increasing competition between the various companies have been the major causative factors in motor vehicle improvements. Government legislation has resulted in very few improvements to motor vehicles.

However, as the motoring world rolls towards the year 2,000, this situation will inevitably change. Most European governments realise that their traffic density is likely to double within the next twenty years, the United States is already faced with enormous traffic problems, and even Canada and Australia will eventually reach their respective traffic density limits.

It seems certain that in the years to come most governments will, through technology, demand greater control over the uses a vehicle is put to, and will exercise greater control over the vehicle whilst it is being used. Some research agencies, such as Britain's Transport and Road Research Laboratory, are already formulating schemes designed to provide external electronic control of motor vehicles.

Within the foreseeable future, the UK public will be protected from drunken drivers by a new electronic system called BLAST (British Leyland Alcohol Screening Tester). The unit, which is connected between the ignition switch and the starter circuit, consists of a central console on which is mounted a keyboard and a small display screen. Behind the display screen are nine lamps in a 3 x 3 matrix arrangement. When the ignition switch is activated, four of these lamps are illuminated, one after the other. A random sequence selector ensures that the numbers and the pattern will be totally unpredictable.

The test consists of selecting and pressing the correct key on the matching keyboard before each lamp is extinguished. If the driver is successful, a green light is displayed, and ignition is available. However, if the driver fails to execute the procedure, a red light flashes and the starter system remains deactivated.

In a series of tests at Birmingham University, subjects from 22 to 62 were tested on BLAST when sober and again after an intake of alcohol. Results showed that BLAST was 90 per cent effective in screening out subjects whose blood alcohol level was above the legal limit. Further tests are scheduled following circuit improvements. However it seems likely that, in the not too distant future, potential drunken drivers will be saved from prosecution (or worse) by their inability to push the right button at the right time.

The development of large scale integrated circuits is leading the way towards radical improvements in vehicle instrumentation and telemetry. For example, Smiths Industries of Great Britain have designed a 'one-wire' system for automobile electrics in which all wiring is replaced by a ring main system consisting of a power lead and control wire passing around the perimeter of the vehicle. A control unit on the dashboard is connected to the same ring.

A remote switch on the dashboard panel control alters a particular code in the main sequence which is transmitted down the main control wire every millisecond. The appropriate accessory electronic module detects the code and stores the information. When the correct code is received four times (this takes about four milliseconds), the accessory is operated. If the accessory fails to operate, a "fail" signal is returned to the control module.

One feature of this system is its ability to accept analog signals. For example, a tachometer sensor connected to the main ring near the motor has its own particular code location. This is detected at the control unit, decoded, and displayed on the instrument in the conventional manner. Further locations can be made available for temperature, fuel, and pressure gauges, etc. It is estimated that the size of the circuit modules will be approximately 1 square inch.

Such integrated circuits offer advantages in terms of both cost and performance. These advantages include: less wiring required, the system is self checking, loom fixture costs reduced, and panel switches are only required to pass small currents. The above system should be commercially available in about five years.

Those who argue vehemently against the introduction of external vehicle control on the grounds of "personal freedom" are, to some extent, betrayed by the very high accident rate on multi-lane roads during periods of fog, snow or other abnormal weather conditions. Such incidents (especially multi-vehicle pile-ups) indicate two possible conclusions: either the driver was unaware of the abnormal conditions in time to moderate his driving; or he was

An experimental, electro-mechanically guided, radar controlled vehicle. This driverless vehicle was developed at the Road Research Laboratory at Crawthorne, Berkshire.

aware but lacked either the discipline or the ability to change his driving. On the assumption that the driver wasn't made sufficiently aware of the hostile conditions a new system called RITA (Road Information Transmitted Aurally) has been developed.

Basically the system consists of a speech recorder and transmitter housed in a roadside cubicle. The appropriate message for any given situation is selected, and the signal transmitted by modulating a very low frequency carrier which is fed into a wire loop buried along the edge of the roadway. The continuously radiated signal is picked up by an aerial coil mounted on the vehicle, rectified and amplified to reproduce the spoken message to the driver via a loudspeaker. The use of a carrier frequency enables different languages to be transmitted on different channels.

As the information given is not obscured by other traffic or weather conditions, and since the driver is less heavily loaded aurally than visually, research engineers believe that RITA will prove to be a valuable aid in reducing the motorway accident rate. If not, then total automation is only a short step away.

One factor is common to all remote control systems presently under development — their high cost. Preliminary estimates indicate an outlay of around £75 per vehicle and £3,000 per lane kilometre. However it is probable that these estimates are far too conservative.

Most systems envisage a road located guidance circuit and a vehicle borne electro / mechanical system to convert signal commands into action. A cable buried beneath the road surface will, when energised with an alternating voltage, become a guidewire. Two sensors on the front of the vehicle detect the magnetic field produced by the AC current flowing in the guidewire, the difference in signal levels detected by the two sensors representing how far the centre of the vehicle is from the guidewire.

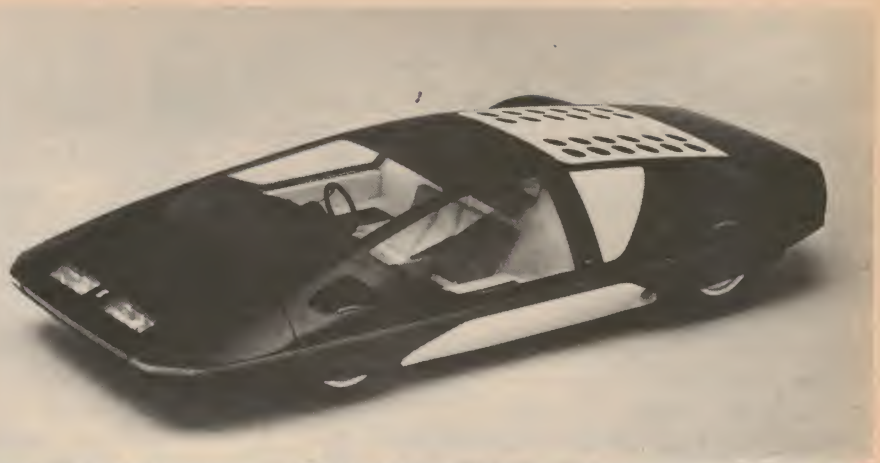
In practice, the signal voltages induced in the two sensing coils are amplified, rectified and then subtracted to produce a DC voltage which is proportional to the vehicle tracking error. The DC signal is applied to a signal conditioning circuit and then to a comparator whose other input is derived from the vehicle's steering wheel position. A voltage is thus produced which is a measure of the error between the desired position of the steering wheel to centre the vehicle over the guidewire and the actual steering wheel position. The error voltage is used to drive an electric motor which controls the steering.

Vehicle speed and braking facilities are controlled in much the same manner. A speed command from the road cable in the form of a voltage is compared with a voltage proportional to the actual vehicle speed, thus producing an error voltage. This error voltage is fed via a signal conditioning circuit to a controller. Depending upon the sign and amplitude of the error voltage, signals varying in mark-space ratio are fed to either the throttle or brake actuators, increasing or decreasing the vehicle's speed as required.

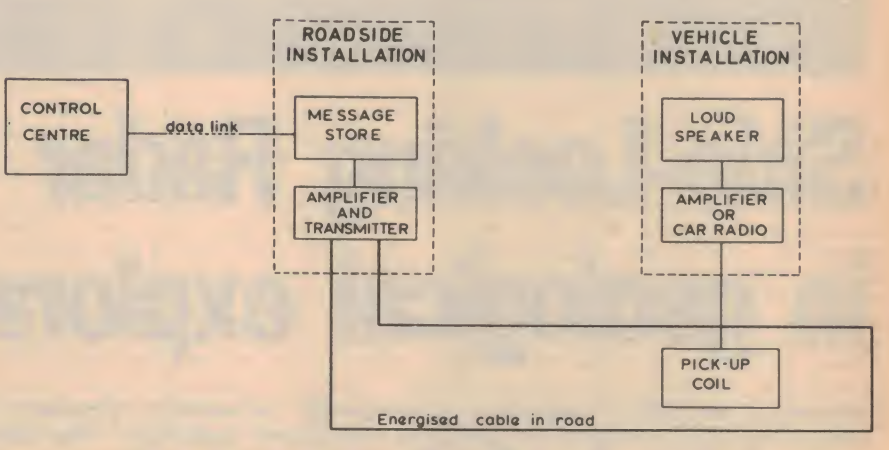
A problem of vital importance in such automated systems is that of maintaining a safe distance between vehicles, and experimentation is continuing in an attempt to determine the best method of achieving the correct spacing. One system, known as the "travelling bucket" system, utilises a travelling wave train in the track, with vehicles swept along it like surf boards. The major disadvantage of this system is that if one vehicle breaks down, following vehicles will be swept onto it. Safety overriders are possible, but these considerably increase the cost of such systems.

Given such drawbacks, most researchers lean towards the "follow the leader" system in which lasers, radar, or ultrasonic devices are used to measure the range and speed of the vehicle ahead and adjust the speed of the following vehicle accordingly.

Through its application to the automobile, electronics has brought the motorist improvements in economy, performance, convenience, and safety. Ironically, there are now indications that electronic techniques will be instrumental in removing the motorist's most prized possession — the freedom to control his own vehicle. The completely "electronic car" of science fiction may not be all that far away. However, it may turn out to be more of a nightmare than a blessing.

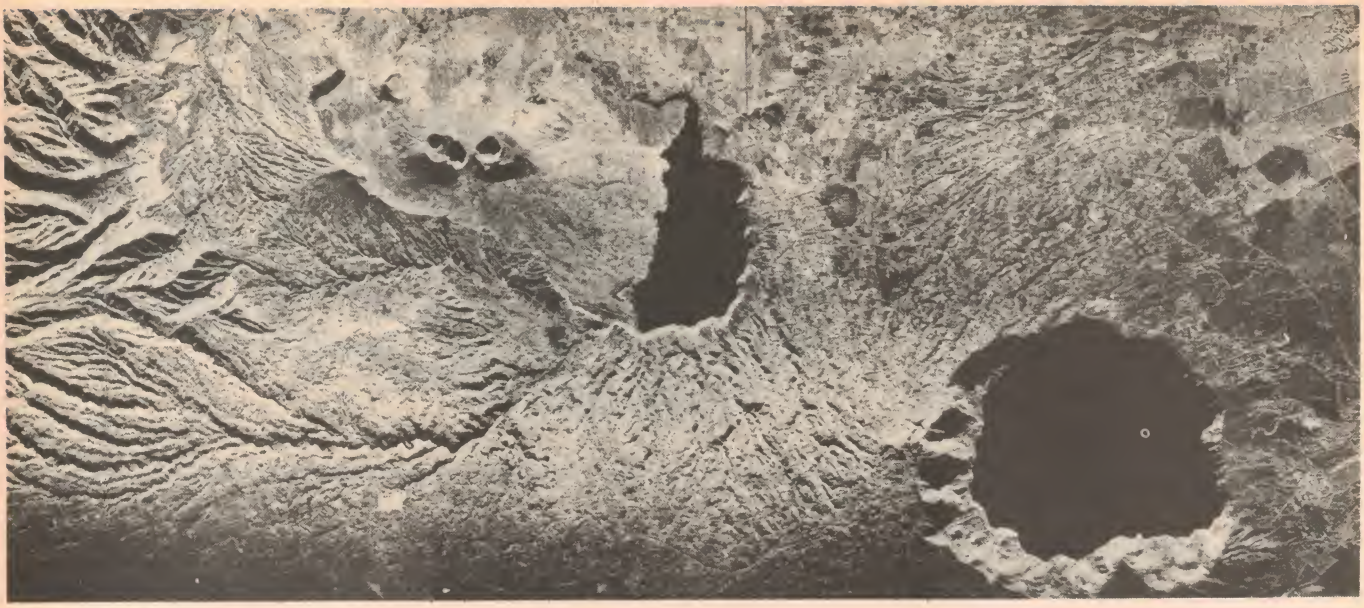


Above: The car of tomorrow — will it look like this? Below: schematic diagram of the RITA concept.



Future instrumentation will be linked to an electronic vehicle control and diagnostic system.

The author would like to thank the Mullard Company of Gt. Britain and the Transport and Road Research Laboratory for their help in compiling this series.



Side-Looking Radar in geological exploration

Advanced electronic technology is becoming increasingly important in remote sensing techniques for geological and mineral exploration. This article describes a comparatively new remote sensing technique: side-looking airborne radar (SLAR).

by GREG SWAIN

Side-looking airborne radar (SLAR) is an entirely military development which has only been declassified in recent years. The technique uses a radar approach to acquire high quality photographic-like images of the ground. These imaging radars have certain special features of interest to the geologist, and they have the additional advantage that surveys can be made through cloud cover that makes conventional aerial photography impossible. In recent years, excellent imagery has been released which has demonstrated the considerable potential of side-looking airborne radar as a remote-sensing tool for reconnaissance geological exploration.

Fundamentally, the method relies upon the propagation of short radar pulses in a fan-like beam from beneath the aircraft, with the plane of the fan perpendicular to the flight direction of the aircraft. Depending upon the characteristics of the terrain encountered, signals of varying amplitude are reflected back to the receiving antenna. Radar signals from directly beneath the aircraft constitute the first signal arrivals, whereas radar returns from the ground some distance off to the side of the aircraft are delayed.

By coherently adding the return signals as the aircraft moves along the flight path, it is possible to effectively synthesize a radar of very large aperture, and thus of high resolving power, while actually using antennas of quite limited size. The use of a scanning print-out system which is synchronised with the pulse transmissions, and which is responsive in intensity to the amplitude of the radar returns, makes it possible to produce photographic images of radar reflectivity of the terrain.

The term "grey scale" is used to denote the variation in tone of the photographic record through the various shades of grey from black to white. A radar set with a large dynamic range will produce a greater variation in tone for a given area than a set with a small dynamic range. The greater the dynamic range and, hence, the larger the number of shades of grey into which the radar image may be divided, the smaller the difference in reflectivity that can be distinguished on it. As the reflectivities between different rocks, soils, types of vegetation, or other features of interest may be relatively small, only sets with a large dynamic range will produce imagery with sufficient tonal variation to detect these small differences.

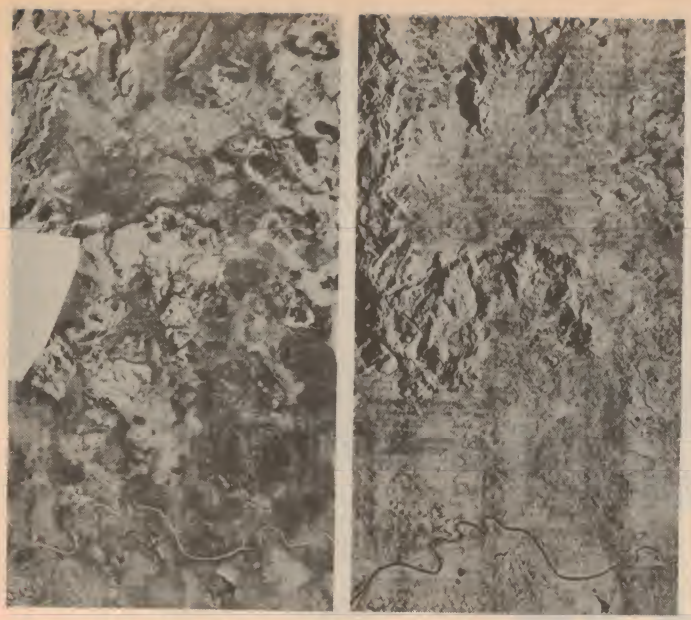
Conventional radar systems utilise frequencies ranging from 220MHz to 40GHz. The military coding for radar bands remains in common use, and is as follows: P-band (220 — 390MHz); UHF-band (300 — 1,000MHz), L-band (1 — 2GHz), S-band (2 — 4GHz), C-band (4 — 8GHz), X-band (8 — 12.5GHz), Ku-band (12.5 — 18GHz), K-band (18 — 26.5GHz), Ka-band (26.5 — 40GHz).

A typical SLAR reconnaissance system, the Westinghouse AN/APQ-69 (XH-1), operates in the X-band and has a peak power output of 180-250kW and transmits pulses of 0.1usec duration at a rate of 1,000-2,000 pulses/sec. The antenna system consists of two identical antennas mounted back-to-back in an antenna pod situated beneath the aircraft. The antennas are 15 metres in length and are provided with plus or minus 4.5deg roll stabilisation. One unusual feature of the AN/APQ-69 SLAR is its ability to scan terrain on both sides of the aircraft; hence the use of two identical antenna systems.

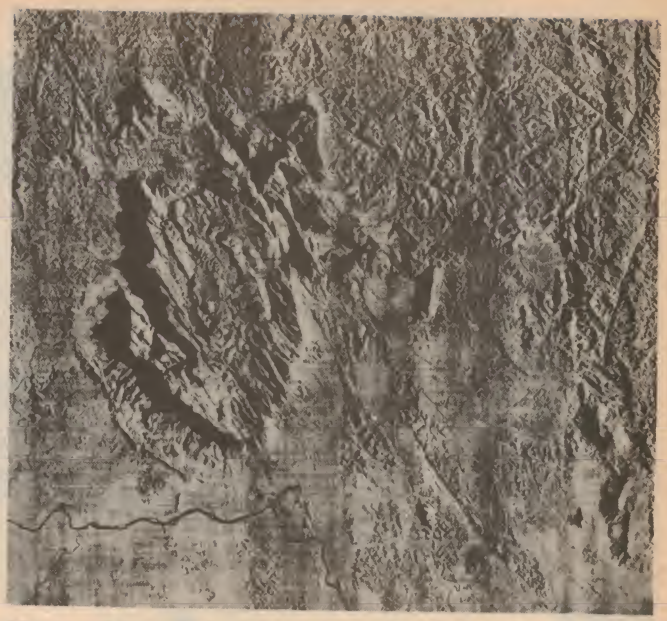
Most imaging radar systems presently in use operate at wavelengths in the high frequency K-bands. Consequently, only a limited amount of penetration into ordinary earth materials is attained. Low frequency radar sets operating in the L- and P-bands are expected to provide more useful geological data since they will have greater penetration into soil and vegetation.

The characteristics of radar imagery, features to be observed, and problems to be solved have to be taken into account in detailed planning for the acquisition of radar data. In particular, to acquire the maximum amount of information, it is important that the survey be flown parallel to the geological strike or "grain" of the earth's crust in the region concerned.

Surveys are generally flown at altitudes ranging from 20,000 to 40,000 feet and at ground speeds between 200 and 400 knots. The effective scan width, or mapping range, is a function of such variables as the radar system employed and the altitude of the survey. For a typical survey, a strip of country approximately 30 miles wide is



A comparison between terrain photographed by an aerial camera (left) and the same terrain covered by radar imagery (right).



Major earth structural relationships are clearly defined on this SLAR mosaic of a portion of southern Venezuela.

scanned during each line flown. Each strip is flown so as to overlap the previous one and thus ensure complete coverage of the region.

Techniques employed in the interpretation of SLAR images are basically the same as those employed by photogeologists in the interpretation of conventional aerial photographs. These images are particularly valuable for delineating various structural phenomena. Surface faulting, folded sedimentary rocks, joints and fracture patterns and geomorphological features may, under proper conditions, be easily identified and located on radar imagery.

Subtle changes in lithology (type of rock) are sometimes depicted quite clearly in SLAR imagery, and this can be further accentuated when the return signals are separated out into two different images: the component which is polarized in the same direction as the transmitted signal, and the component which is perpendicularly polarized with respect to the outgoing signal. Some types of terrain have the ability to depolarize the return signal more than others, thus providing a useful parameter for differentiation between soil and rock. Bodies of water tend to absorb radar pulses, and as a result are represented as black on the photographic record.

Examination of the accompanying photographs will reveal dark patches known as radar shadows. These shadows are usually caused by topographic features of high relief, and represent regions where there has been no return of the transmitted pulses. Although information is lost in the shadow region, the extent of the shadow indicates the height of the shadowing object and, more importantly, is extremely useful in emphasising linear features such as faults and joint systems. This accentuation of linear features is particularly marked when they lie parallel to the flight track, since maximum shadow enhancement will be obtained.

Side-looking airborne radar has several inherent advantages when compared to conventional aerial photography. It permits good quality imagery to be obtained through cloud cover, allowing pictures of the earth where aerial photography is hampered by persistent cloud conditions. In addition, the large regional aerial coverage obtainable from high-altitude aircraft often enables major geological structures to be traced for great distances with relative ease. Regional geological relationships may often be overlooked on large-scale aerial photographs, in which detail may be the dominant factor.

Above: the Goodyear Caravelle operates at 40,000ft. The belly radome houses the radar antenna. Below: workmen adjust the radar antenna under the Caravelle.

Another advantage of SLAR is the absence of tonal discontinuities normally associated with air-photo mosaics. Caused by variations in shadow, light and climatic conditions, the effect is virtually eliminated from SLAR imagery because radar always uniformly "illuminates" the target area.

To date, only single frequency radars have been used for terrain data acquisation. This may be compared to taking a picture through a camera lens that will only admit one frequency of blue light. Comparison of returns from several frequencies or, perhaps, multifrequency radars will certainly increase the level of extractable information. Longer radar wavelengths may be able to penetrate vegetation and surficial cover and yield significant geological data.

Playmaster 140

PART TWO
by NEVILLE WILLIAMS

Last month, we introduced our new quadraphonic amplifier, the Playmaster 140, and detailed its basic design approach. In this issue, we address ourselves to its actual construction, beginning with the chassis and smaller components and progressing to the various modules which have to be fitted into it.

In the interests of economy and accessibility, we used a simple dish chassis, as pictured. Dimensions of the prototype are 38.3cm wide, 28.1cm deep and 9cm high. Such a chassis can be slid into a wooden case, if your preference or your skill lies in that direction. Alternatively, a simple metal fold can be slipped over the top and secured to the side flanges by self-tapping screws. Such a cover would normally be dressed with a wood-grain adhesive cloth.

Cooling is not a critical problem with the particular output stages, but it certainly should not be ignored, particularly if you are likely to push the amplifier towards its power limits. There is a pattern of holes under the chassis and, for these to be effective, the chassis must be stood up on rubber feet. If a wooden case is used, make sure it has a cut-out to expose the holes, with feet on the cabinet instead.

A wooden case or metal top cover should also have some kind of venting at the top to allow free air circulation. The styling is a matter for individual suppliers.

In approaching the construction of the amplifier, we strongly advise that you instal the components along the rear and front edges of the chassis, interconnecting them by wires laced together into cables. An alternative, which you might prefer is to push the wires through a series of rings cut from nylex tubing.

By doing this when the amplifier is little more than a shell, you will have room to work. If you do things the other way, installing the modules and then simply running the wires individually, you will almost certainly end up with a disorderly tangle.

Instal the DIN input sockets first, all with pin 2 towards the bottom of the chassis dish. The phono socket is at the end with a 3-lug tag secured under the mounting rivet adjacent to pins 3 and 5. The other sockets follow in the same order as in the main diagram (page 33, last issue). We used a hand rivetter to attach the sockets but screws and nuts can be used instead — if you can find any!

To fill the central socket hole, as yet unused, we mounted an ordinary octal socket.

Next come the four polarised McMurdo type loudspeaker sockets. If you plan to use rivets, make sure to get the sockets with metal, not moulded, flanges. The larger "earthy" pins go towards the centre of the chassis.

Alongside the loudspeaker sockets are the fuseholders, which need to be fitted with 1.5A fuses.

Then comes the power cord, which will involve an access grommet, a 3-hole junction block and a cord clamp.

Also attached to the inside of the rear chassis face by ¼in stand-off spacers is a 20-lug section of tagboard which accommodates the output shunt and headphone feed components. This can be made up and mounted temporarily in place, ready for the associated wiring looms. See last month's diagram for details.

The remaining item on the back panel, a phase reversing amplifier for 4-channel external input, can be ignored for the time being and will be covered later. Just make sure that you leave space for it.

Turning now to the front of the chassis, we elected to use slide potentiometers for a variety of reasons: styling, convenience of control and electrical tracking. Those shown have a travel of 4.5cm. The volume controls are 50k log, the tone controls 500k linear, and the balance control a 2meg linear. This latter value was chosen, by the way, to maintain a high input impedance for the high level inputs. A lower value of balance pot would give smoother control, with some loss of input impedance and overall gain. We didn't make the change in the prototype amplifier because, in practice, the balance control is not used a great deal anyway.

Mounting the slide potentiometers does present something of a problem, in that slots are more difficult to produce and align than simple mounting holes.

More than that, the potentiometers which we used were supplied with special semi-roundhead screws, not intended to be exposed on the front panel, yet not suitable for counter-sinking. In any case, if the potentiometers were mounted directly to the front panel, too much of the shafts would be exposed.

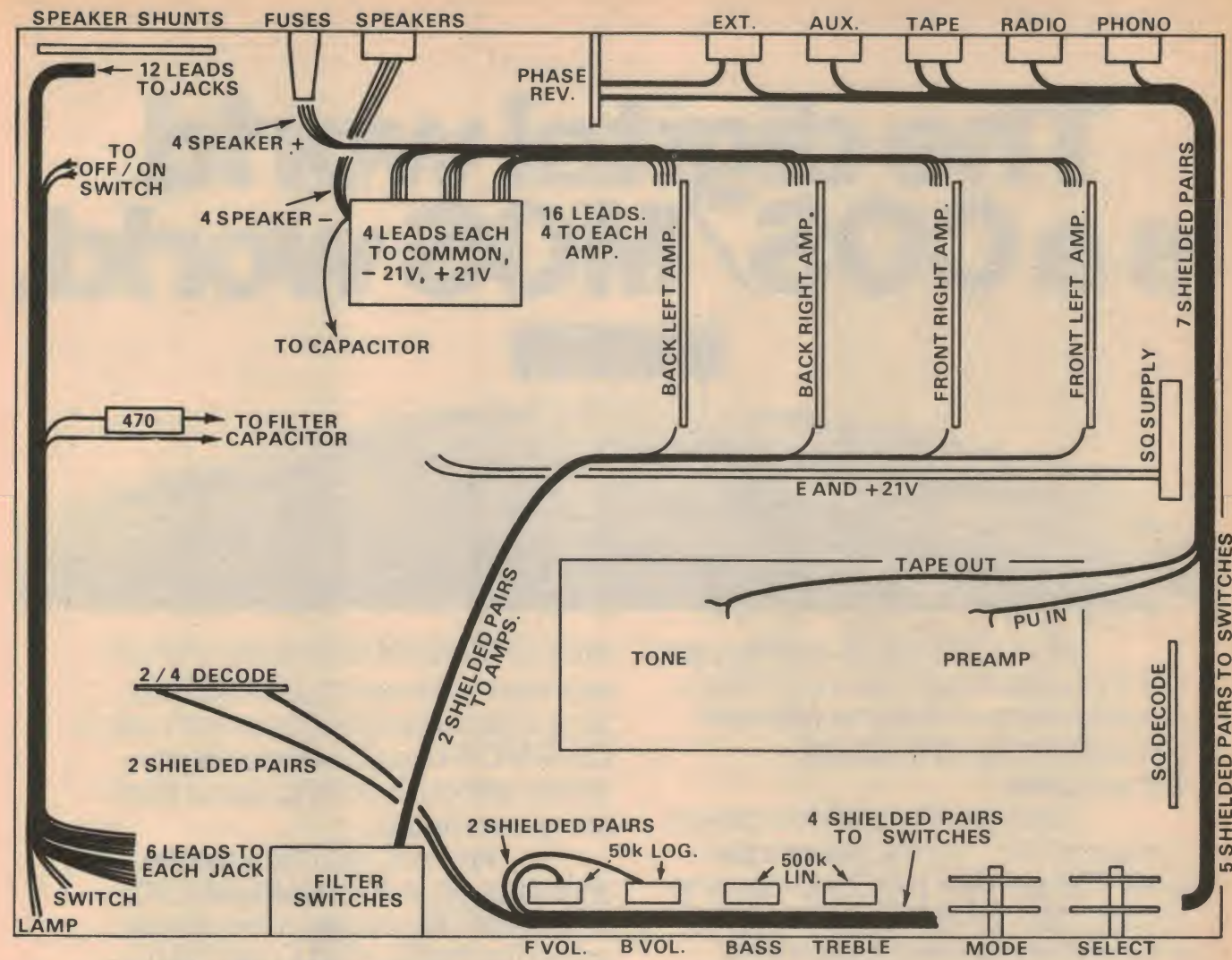
What we did was to bend up two brackets from scrap 16g aluminium, shaped to accommodate the five slide potentiometers. Bolted by a flange to the bottom of the chassis, they support the potentiometers about 1cm back from the panel. Most likely, similar brackets, will be supplied as part of the chassis hardware but they aren't hard to contrive with ordinary bench facilities.

Provision of the bracket obviates problems with mounting screws, allows fore and aft adjustment of the control arms and also permits ready replacement of a potentiometer, should it ever be necessary.

A variety of push-on knobs, is available to suit slide potentiometers but, in our view, the common large black rectangular knob best suits the styling. It measures about 2cm wide and 1cm high.

One point we should stress: Make sure that you mount the volume controls with the low resistance segment of the element towards the bottom, otherwise the logarithmic taper will be working against, rather than for, smooth control. It may be wise to check this with your multimeter before mounting the controls finally in position.

The Select and Mode switches mount directly to the front panel, although you may have to pack them back with at least



This diagram shows the layout of the major wiring harnesses in the new amplifier.

one washer to avoid having too much of the thread protruding. It would be wise at this stage also to select suitable knobs, preferably with a skirt to hide the nuts, and to cut the switch shafts to the proper length. Mount the switches so that, viewed from the back, they occupy the positions shown in the main diagram.

The filter block at the other end of the front panel uses two McMurdo type push-button switches, spaced 35mm between centres and each providing a 4-pole change-over function. These have to be set back on spacers about 1.5cm, so that only part of the button is exposed through the front panel.

We suggest that you obtain a version of the switch assembly with a backplate fitted. It stabilises the switches and also provides a convenient insulated common point for the "earthy" circuitry. McMurdo's part number for this switch is S / 4700.

Details of the filter wiring are given in the accompanying drawings. Note that the contact pins pass straight through the body of the switch and it is purely a matter of convenience whether connection is made to the pins on top or underneath. With larger components, as shown, it is convenient to use some top, some bottom pins; with small components it may be different.

In fact, if you want to save time and money, the amplifier can be put into service without the filter switches. Simply route the signal lead direct from the volume control tapping to the power amplifiers. However, we do suggest that you make the lead a little longer than necessary so that it can be re-routed via the switch assembly at a later date.

Alongside the filter switches is a filament type indicator lamp fed from the DC supply. Such lamps are typically rated at 6V, 40 or 50mA and can be supplied through a 5W resistor of about 470 ohms. You may have to experiment with the resistor to get adequate brightness, while conserving current — and lamp life.

Below the lamp is an ordinary mains type off-on toggle switch.

Indicator lights and switches vary from miniature affairs to quite bulky ones. We suggest that chassis makers provide only small holes in the panel and escutcheon, sufficient for the smallest components. If you fancy something larger, or have no real choice, the holes can easily be enlarged as necessary.

One other option should be mentioned: McMurdo can supply a switch assembly (S / 4727) with three push buttons in line, two of them operating the filter switches and the third a mains switch. This can be mounted readily in position, provided the indicator lamp changes place with the power switch. The panel markings will not be upset because the one word "Power" applies to both functions.

The remaining items on the front panel are two stereo headphone sockets. These are rather special types but are available from at least two sources: McMurdo and A & R / Soanar. They provide connection to both headphone actives, remembering that the convention is to wire the left channel to the plug tip.

But the sockets also provide two switch functions which MUST be electrically insulated from the headphone circuitry. When the headphones are plugged in, two pairs of contacts open which are wired to break the circuits to the respective loudspeakers.

We assume that suppliers will provide a suitably marked escutcheon to fit in front of the amplifier chassis panel. It will be locked in place by some of the controls but, before it is finally mounted in place, it may be wise to anchor the corners and centre with blobs of a suitable cement to prevent it from being kinked.

Next logical step is to provide mounting for the four power modules. Many options were open to us when planning the prototype but we settled for the one shown. It will involve you in a little bench work but should be inexpensive and with the advantage of good accessibility.

You will need two scraps of particle board or wood 17.5 x 4.5 x 1.5cm and a couple of scraps of composition board about 17.5 x 2.5 x 5cm. Run saw cuts part way through the larger pieces wide enough to receive the edges of the modules, drill holes for the

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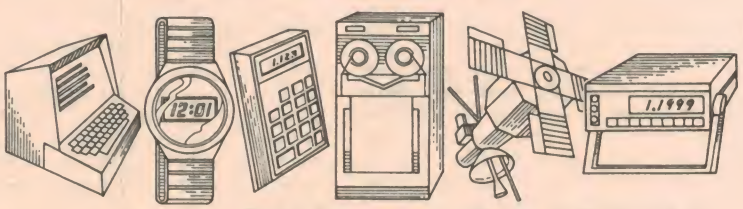

For information, write on letterhead to Amalgamated Wireless Valve Company Pty. Ltd. (Technical Information)
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Telephone: (02) 797 5757. Telex: 24530.
Postal address: PO Box 24, Ashfield, NSW 2131.

incoming wiring and fix the thinner pieces to the bottom as footings to keep the modules clear of the chassis. Details are given in the accompanying drawing.

For the sake of appearance, we sprayed the prototype supports flat black.

They are held in place by two countersunk screws in each, driven up through the bottom of the chassis. The rear one in our case was mounted 3cm from the rear of the chassis and about 2cm from the end. Exact positioning will, of course, depend on the boards and your sawcuts but it is well to attend to the matter at this early stage.

The next item to assemble is the 9+9 tagboard, diagrammed last month, which carries the four silicon rectifiers, and provides convenient distribution for some of the power wiring. We used Motorola MR751 because at the time they were the cheapest and most readily available. Other rectifiers could be used with a PIV rating of 100 or more and a current rating of 3A or more. The tagboard should be stood off the chassis on 1cm or ½in pillars.

At this stage, it is probably appropriate to plan, make up and install, the looms which account for most of the wiring in the amplifier. The rest of the wiring can be added as the modules are inserted.

To assist in the task, we have prepared a wiring diagram which shows the nature and position of the looms.

First off, seven pairs of figure-8 shielded and insulated leads are necessary from the input sockets to the Select switch, with a couple branching out halfway to the preamp board. Leave a fair amount of slack at each end when you make up the loom so that the leads can loop naturally to the points where they are supposed to terminate. Be careful to observe the requirements set out last month in regard to termination or otherwise of the shield braid.

Depending on how economically you work, it is likely that you will need approximately 7m or 8yds of twin shielded cable for the amplifier as a whole.

Another, much simpler, loom of shielded wire runs from the filter switches to the power modules. Split the pairs at the module end and pass one shielded lead through a hole adjacent to each module. Allow for a generous loop inside, so that the modules can, if necessary, be lifted out for attention, while still in operating condition.

Another simple loom runs from the switches to the volume controls and to the 2/4 decoder. This can tuck conveniently into the space between the pot bracket and the front panel, just above the travel of the pot arms.

Incidentally, you will need a multimeter when wiring in these various looms, since it is difficult to trace leads once they are laced securely and laid into position. The colour coding will enable you to identify left and right channels but the meter will be necessary to sort out the cables.

Turning now to the non-shielded circuits, a 16-lead harness needs to be made up to cope with the mains switch, indicator lamp, and the headphone sockets. We suggest you make an effort to get a few feet of as many colours as possible for this one, otherwise you will have real fun sorting them out. Either that, or the wires will have to be soldered in place as neatly as possible and then laced. Fortunately, this will be reasonably practicable in the empty chassis.

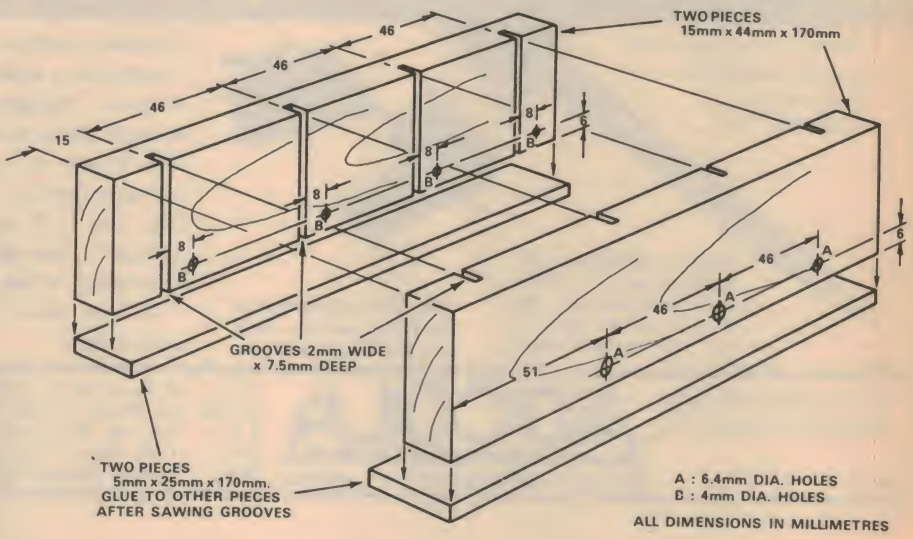
The one remaining loom carries four wires to each of the power modules. Three of the four groups pass through holes in the mounting bracket and should again have enough slack to allow the modules to be withdrawn, if necessary.

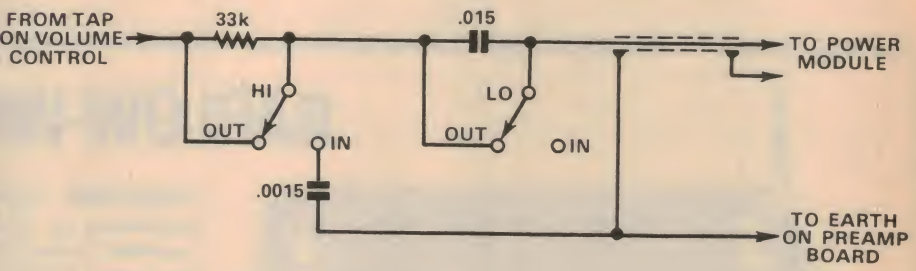
By the time you have made up these looms, installed them and completed as much of the associated wiring as is possible you will, in fact, have completed most of the wiring in the amplifier. What is more, it should look tidy and disarmingly simple!

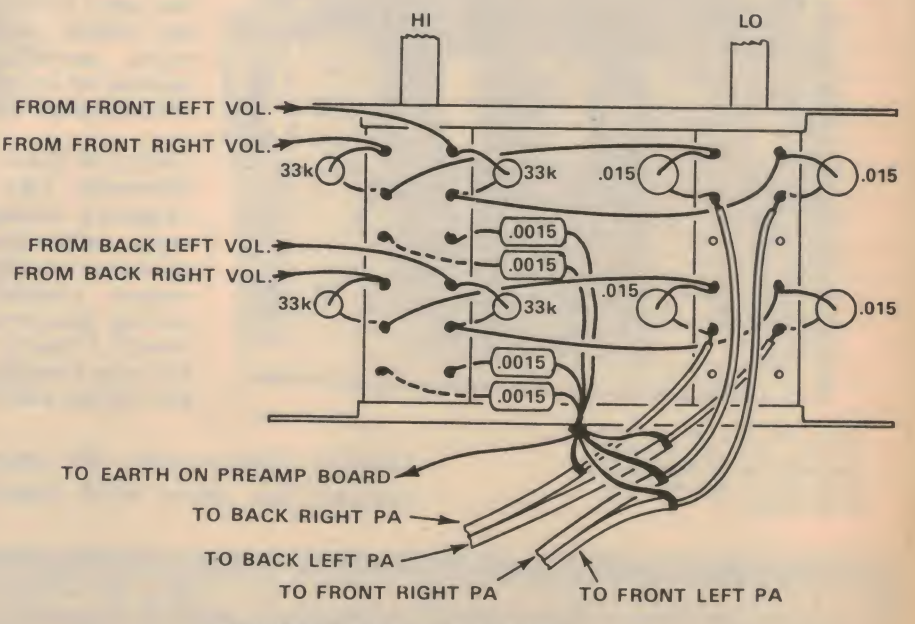
It remains only to add the power supply components and the main chassis dish should be just about complete, ready for the modules, which have yet to be described.

In the prototype we used two 2500uF 35VW Elna electrolytics, connected in parallel for the positive supply, and a single 3000uF unit for the negative supply. These are simply bolted in position, using countersunk screws. As mentioned earlier, electrolytic capacitors seem frequently to change in shape and rating. Variations should not cause concern, however, provided alternative capacitors fit, have adequate voltage rating, and not less than the required capacitance value.

The power transformer must deliver an







PLAYMASTER 140 : HI, LO FILTERS

At top is the information you need to make the supports for the power module boards while below are the circuit and wiring diagram for the filter switch assembly.

output of 15-0-15 volts under quiescent conditions, but it must exhibit only modest voltage drop as the load peaks up to about 100 watts with all channels driven simultaneously.

Ferguson's answer was the PF3588, having a primary winding resistance of 20.5 ohms and a secondary winding resistance of 0.47 ohms. Although the nominal rating of the transformer is only 2A, it met our needs very well, showing surprisingly little temperature rise after a long listening session at high volume.

Other manufacturers may, of course, offer an equivalent unit.

In the prototype transformer, the mains lugs were exposed at the top and we have suggested that the assembly be modified to keep them on the underside. If they don't do this, it would be wise to cover the lugs in some way to minimise risk of shock.

One final point: A 0.01uF ceramic capacitor (100V or higher) should be connected from each end of the 15V secondary winding to chassis to bypass mains-borne RF energy.

With these remaining components installed and wired up, attention can be turned to the various modules.

While the power amplifier modules have been derived from the original Playmaster 136 design, there are important differences.

The most obvious has already been mentioned, in that the new board does not carry any power supply components. Power input is by three wires from the loom mentioned earlier; power supply earth or common, plus-21V and minus-21V. A fourth lead from the same end of the board feeds the active side of the loudspeaker circuit. The remaining connection is the shielded signal input lead which also provides the earth link back to the preamp board.

Adjacent to the plus-21V lead is a link into which a milliammeter can be inserted to measure the quiescent current of the output stage. For simplicity, we used a loop of hook-up wire with a soldered joint in the middle. In the finished amplifier it rests on the top of the support bracket, out of harm's way.

The passive components, resistors and capacitors on the wiring diagram require no special comment.

Note, however, that we have added one resistor to the amplifier, a 6.8k bridging one side of the quiescent current adjustment potentiometer. This is to protect the output transistors in the event that potentiometer wiper or element becomes open-circuit. What happens in this circumstance is that the quiescent current control transistor, PN3565, is turned off and the output transistors are turned hard on, drawing heavy current which can cause them to burn out.

While the possibility of an open curcuit potentiometer is fairly remote, the 6.8k resistor provides cheap insurance. Now, in the event of an open circuit pot, the control transistor is turned on and the output transistors draw zero quiescent current. In this condition, cross-over distortion occurs but no damage eventuates and the situation can be rectified.

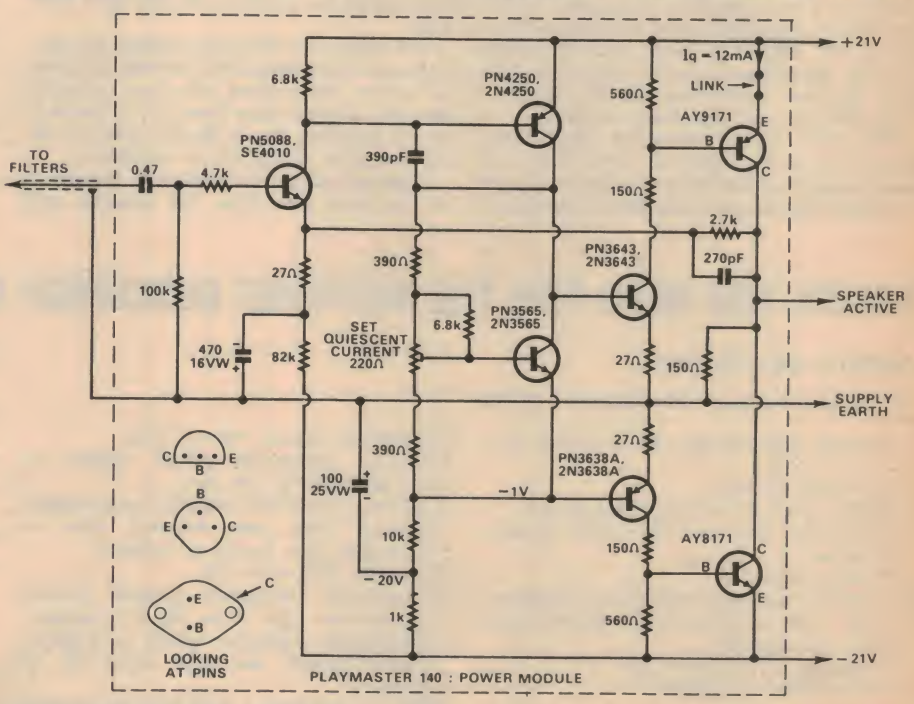
The resistor may also be added to existing Playmaster 136 amplifier boards. If it is added, don't forget to reset the quiescent current to 12mA.

The transistors themselves call for special comment.

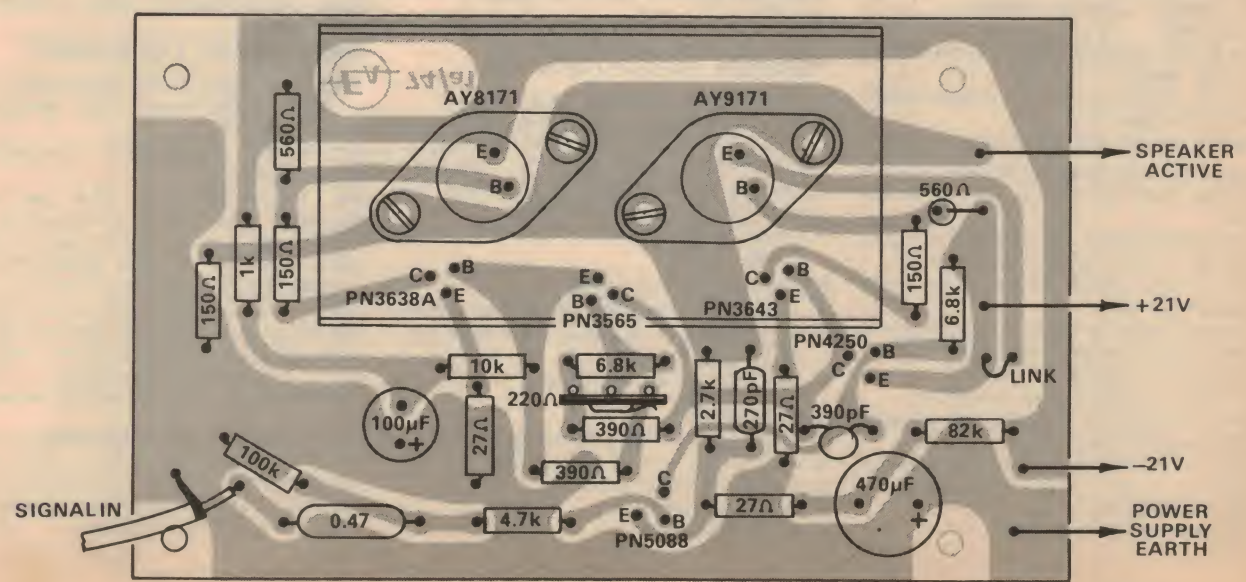
The 136 board and this new one were designed for Fairchild transistors of the "glob top" variety, having their connections in a triangular configuration. The relevant type numbers have been retained on the circuit (prefix letters SE or 2N) to assist those who may want to use existing transistors or rebuild modules from a 136 unit.

Changeover to a more modern mass production technique has necessitated dropping the glob-top construction in favour of the "TO-92" configuration, in which the pins are in line. These new transistors, having identical electrical characteristics, will be supplied exclusively in future. Their type numbers, also shown on the circuit, begin with the letters "PN".

There is one point about which readers should be especially warned: Other manufacturers have adopted the TO-92 configuration for much the same reasons as



Above is the circuit diagram of the power module while below is the printed board shown actual size. Note the link for testing quiescent current.



Fairchild but the disposition of the pins relative to the flat on the case is different. Therefore, don't wire Fairchild transistors to Philips data or vice versa or you will end up with transistors the wrong way round.

With the PN5088 and the PN4250, it is just a matter of bending the leads sufficiently to fit into the triangular pattern of holes, the transistors sitting about a centimetre above the surface of the board.

The real difficulty has to do with the other three which need to make physical contact with the output transistor heat sink to provide thermal feedback.

With the glob top transistors, the requirement was met by providing three suitably positioned dimples in the underside of the heatsink, each partially filled with silicone paste. The small-signal transistors were dropped in position on the board but not soldered. The heatsink carrying the power transistors was then locked in position with the power transistor leads just emerging through the copper pattern. This done, the glob tops were pushed up into the silicone-filled dimples and the leads soldered.

The TO-9 style transistors don't lend themselves to this approach. They don't sit down snugly on the present board and the small, flat top doesn't mate naturally with a dimple. We are therefore suggesting that holes be drilled in the heatsink, which will be a clearance fit for the TO-92 bodies, allowing the transistor to sit part way through the heatsink. A blob of silicone compound can blend the two thermally.

The mounting method has a possible bonus in that the transistors are no longer trapped under the heatsink. They could, if necessary, be extracted and replaced through the holes.

Turning now to the actual construction of the power modules, the first step is to inspect the heatsinks, which should be of aluminium, not less than 16 gauge. Make sure that the two power transistors sit flat against the surface, with mounting holes aligned and with adequate clearance around the base and emitter pins. If there is any inaccuracy, lead the holes as necessary with a small round file.

In fact, we rubbed the inside surface of our own heatsinks with a large flat fine-gauge file to remove any high spots and then buffed the surface all over with steel wool.

Now check the heatsinks against the wiring board. Make sure that the bolts securing the power transistors can pass straight through, and the pins likewise. If there is any fit problem, the mounting holes in the board can be elongated as necessary.

If the small-signal transistors happen to be the older glob tops, the heatsink will need dimples or countersunk holes in the underside. If, as likely, the transistors are of the TO-92 configuration, the heatsink will need snug clearance holes instead. In fact, dimple type heatsinks can be adapted by drilling appropriate holes. They may not be concentric with the dimples, however, since the TO-92 transistors sit most naturally between the collector and emitter pins, with the base lead kinked outwards to fit the triangular pattern in the board.

With all this sorted out for each of the boards, the heatsink assemblies can be completed. Smear the underside of the power transistors with silicone compound and secure the transistors firmly to the heatsinks with ½-inch long bolts and nuts, either ⅛ Whitworth or 5BA. The transistors do not need to be insulated from the heatsink. In fact, the heatsink and mounting bolts form part of the collector circuitry.

You will need four spacers per board, either 4mm or 5/32, such that when the heatsinks are mounted, the base and emitter pins of the power transistors just come through the copper pattern. We found some brass nuts of a larger size which we turned into spacers by running a ⅛in clearance drill through them. This done, the power transistors assemblies can be put aside for later installation.

On the wiring board itself, it is wise to smear the copper around the heatsink mounting holes with a thin layer of solder. If

PARTS YOU NEED FOR THE SECTIONS DESCRIBED SO FAR:

MAIN SECTION

(As per diagram, page 33, December 1973)

- *1 chassis, nominally 38 x 28 x 9cm or 15 x 11 x 3½ins.*
- *1 Escutcheon plate.*
- *1 Metal cover or wooden case to suit.*
- *1 Mounting bracket for slide potentiometers.*
- *4 Rubber feet.*
- *2 3-pin DIN sockets, with plugs as required.*
- *3 5-pin DIN sockets (180 degree) with plugs as required.*
- *2 Tagstrips, 3-lug and 4-lug.*
- *1 Octal socket (optional).*
- *4 Polarised loudspeaker sockets and plugs (McMurdo or similar).*
- *4 Fuse holders (Sato or similar).*
- *4 1.5A fuses.*
- *1 Power cord, with grommet, clamp, 3-way terminal block.*
- *1 2-bank, 4-pole, 5-position rotary switch (MSP Oak type F).*
- *1 2-bank, 6-pole, 3-position rotary switch.*
- *2 2-gang 50k log potentiometers (volume controls) with mounting screws, 4.5cm travel.*
- *2 2-gang 500k linear potentiometers (tone controls) with mounting screws.*
- *1 2-meg single linear potentiometer with mounting screws.*
- *5 Push-on knobs for slide potentiometers.*
- *2 Skirted knobs for Select, Mode switches.*
- *1 Mains off-on switch (if required).*
- *1 6V 50mA indicator light assembly.*
- *2 Stereo headphone sockets with isolated stereo speaker switching (see text).*
- *2 Pieces of particle board and composition board to support power modules. (See text and diagram.)*
- *1 Tagboard, 9 lugs per side.*
- *2 Mounting pillars, 1cm or ½in.*
- *4 MR751 (Motorola) silicon diodes or similar (100PIV, 3A min).*
- *7 Metres (8yds) twin shielded and braided figure-8 wire, plus hook-up wire as necessary in a variety of colours.*
- *1 Resistor 470 ohm 5W.*
- *2 Electrolytic capacitors, 2500uF 35VW, upright can type. (Elna RG or similar.)*
- *1 Electrolytic capacitor, 3000 or 3300uF, 35VW upright can type. (Elna RG or similar.)*
- *1 Power transformer 15-0-15V 2A nominal (see text). Ferguson PF3588 or similar.*
- *2 0.01uF ceramic, 100V or higher.*

POWER MODULES (4)

- *4 Printed wiring boards 12.3 x 7.6cm.*
- *4 Fairchild bimesar transistor kits each comprising PN5088 (or SE4010); PN4250 (or 2N4250); PN3565 (or 2N3565); PN3643 (or 2N3643); PN3638A (or 2N3638A); AY9171; AY8171.*
- *4 Aluminium heatsinks, 16g; 7.6 x 4 x 2.7cm overall.*

RESISTORS (½W, 10%)

- *4 100k; 4 82k; 4 10k; 8 6.8k; 4 4.7k; 4 2.7k; 4 1k; 8 560 ohm; 8 390 ohm; 12 150 ohm; 12 27 ohm.*
- *4 220 ohm preset tab pots.*

CAPACITORS

- *4 470uF 16V vertical electrolytic.*
- *4 100uF 25V vertical electrolytic.*
- *4 0.47uF 160V polyester.*
- *4 390pF polystyrene.*
- *4 270pF polystyrene.*

SHUNT, PHONE BOARD

- *1 Tagboard, 10 lugs per side.*
- *2 ¼in mounting spacers.*
- *4 0.47uF polyester (small, typically 50V).*
- *4 15-ohm ½W resistors.*
- *4 330-ohm ½W resistors.*

FILTER ASSEMBLY

- *1 Isostat 2-push-button switch assembly (McMurdo part S-4700; or 3-push-button assembly S4727, which includes mains switch).*
- *4 0.015uF polyester capacitors, 50V or higher.*
- *4 0.0015uF polyester capacitors 50V or higher.*
- *4 33k resistors ¼ or ½W.*
- *2 Mounting spacers, 1.5cm or ⅝in.*

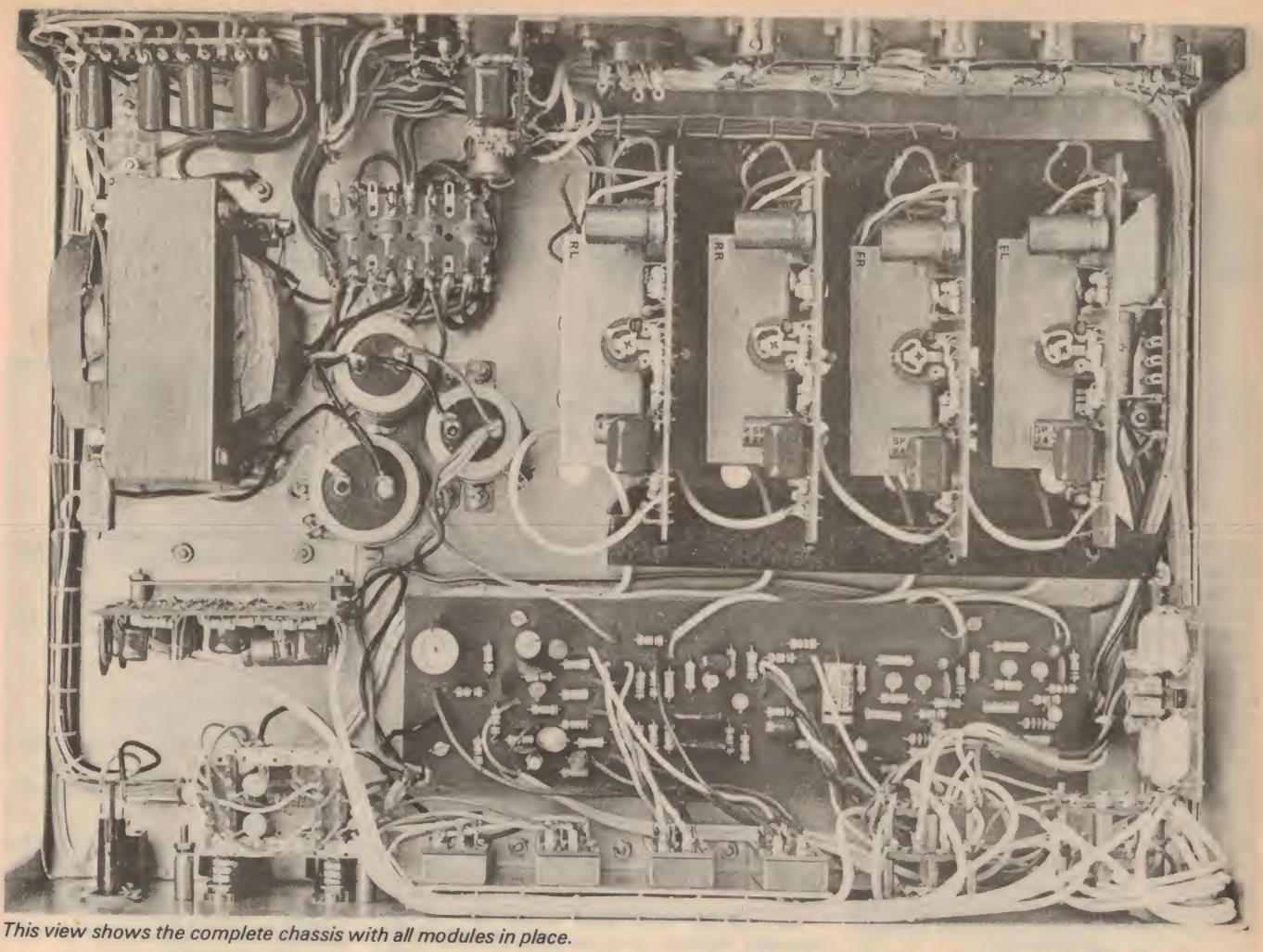
MODULES TO COME

***PREAMP AND TONE CONTROL** board, as for the Playmaster 136, described in December 1972.*

***STEREO-24 ADAPTOR,** described in November 1972.*

***SQ DECODER**. This has yet to be described in detail but it involves a small printed wiring board, with plug-in provision and a McMurdo or other chassis mounting socket. One Motorola MC1312P IC, which can only be sold by distributors having a royalty arrangement with CBS Inc. Plus 11 ½W resistors, mostly unusual values; 10 small polystyrene capacitors. 1 220uF 25VW electro. 4 4.7uF 50VW electros.*

***EXT. 4 PHASE CHANGE:** Built on a piece of Veroboard 6.7 x 3.7cm, this module contains 2 small signal transistors, 13 ½W resistors, 4 0.47uF polyester capacitors and 1 220uF 25VW electrolytic.*



This view shows the complete chassis with all modules in place.

this is done, the nuts will bite into the solder when they are finally tightened and make good contact between the transistor collectors, heatsink and mounting bolts and the copper pattern on the board.

At this stage, the remaining components can be installed as per the diagram. Use an iron with a clean, slender tip and flow the solder around each component lead as quickly as possible, to avoid overheating either the pattern or the component. Make sure that you install the electrolytics with the correct polarity.

This done, the three "PN" transistors contacting the heatsink can be slipped into position without, however, soldering them to the pattern. Now slip the heatsink assembly into place, passing the power transistor leads through the board, and the three small transistors up into the clearance holes. Secure the heatsink.

Raise the TO-92 transistors by a small amount and smear silicone compound around them. Pull them back down into the holes so that they are about 1mm proud of the surface and solder them into position. Flow a generous collar of silicone around the head of each.

Solder the pins of the power transistors, check everything over carefully, and the module(s) should be ready to drop into position in the chassis.

Before doing this, however, the basic chassis assembly should be activated to make sure that the power supply is delivering the correct voltages, etc. We show a position on the power distribution board where a resistor can be inserted temporarily in the transformer CT lead. Something around 15-22 ohms, 3W could be used; it will not offer complete protection against mishaps but it will limit the current if there is something wrong between either side of the supply and common.

Having made sure that the supply wiring is complete and that no trailing wires are resting against the chassis, plug in and switch on. If all is in order, the indicator light should come on and voltages, plus and minus 21.5 approx, should appear across the respective filter capacitors.

You are ready to install and check the power modules, one at a time. But first a word of warning:

While the dial lamp will discharge the negative supply capacitor after switch-off, the positive line filter may retain its charge for many hours. If, while working on a module, you discharge the capacitor through the wrong path, one or more transistors can be ruined. Remember to discharge the capacitor before you dive in with a soldering iron. Better still, wire an oddment resistor (say 680 ohms 5W) temporarily across the positive filter, so that it will discharge automatically.

Install the first module, connect it up as necessary, and insert a milliammeter in the link, with plus to the supply, and set to the 250mA range. Rotate the current set potentiometer, as viewed in the chassis fully anti-clockwise, and set the volume control pot at full off. Since the earthy side of the pot may not at this stage have an earth return, run a temporary link to a chassis earth.

Now watch the current meter and switch on. If the meter slams over, there is something radically wrong. Switch off instantly and check. You may have the power transistors interchanged, or one of the other transistors the wrong way round. Whatever you do, don't tempt fate by switching on again and repeating the overload condition — whatever is the cause.

In fact, the current flow with the preset pot retarded, should be zero. If it is, reset the milliammeter to 50mA and carefully rotate the potentiometer clockwise. Bring the current up to 12mA and leave the module run for a few minutes. If all is well, switch off, remove the milliammeter and close the link.

Note that the current should be set without a loudspeaker or other load connected. When the loudspeaker is plugged in, current distribution in the output stage will change due to the small offset voltage (0.2V approx) across the loudspeaker terminals.

By now connecting a loudspeaker and feeding a signal to the volume control from any source capable of producing a reasonable signal across 50kohms, it would be possible at this stage to check the module for sound, or yet again to run instrument tests.

Other modules can be added progressively, and similarly checked. It is far better to do this than to wire all the modules in and switch them on simultaneously. One with an inadvertent fault could be "cooking" for several minutes while you adjusted the others!

(To be continued)

Simple dual power supply for op amps

Thinking of experimenting with some of the low cost op amps that are now readily available? If so you can probably use this simple dual-polarity power supply, designed especially for the job. It uses very few parts, and can be built at low cost.

by F. G. CANNING

Now that linear circuitry such as audio amplifiers, modulators, active filters, comparators and many others is tending increasingly towards the use of integrated-circuit units rather than individual transistors and discrete components, the experimenter and circuit applications engineer begins to have a real need for a simple power supply unit which is specifically designed to feed such ICs, as a stable replacement for batteries. The rapidly-increasing use of the so-called Operational Amplifier or "Op Amp" in particular calls for specific voltage, current, regulation and hum requirements which, while they fall ideally within the province of battery supply, can nevertheless be met by a mains-operated unit with the added advantages of low running cost, stability and reliability.

The circuit described here has been designed to power up to six or seven operational amplifiers simultaneously, and is believed to meet these requirements. Additionally, it can easily be adapted to supply much higher currents at a higher voltage — sufficient to supply, for example, Class B amplifier output stages of ten to fifteen watts whose earlier stages can also be supplied from the unit, whether or not they use operational amplifiers. It can thus be regarded as a fairly flexible arrangement, despite its simplicity.

The typical operational amplifier now freely and cheaply available, such as the uA709 and uA741, normally requires both positive and negative power supplies. The usual voltage for each supply is 15 volts, though lower voltages can often be used for certain applications. However, lower voltages in general only restrict performance so there is little point in providing for them. Therefore, in this design no provision has been made to continuously vary the output voltages.

Some linear integrated circuits may be met for which unequal positive and negative supplies are specified, eg, plus 15V and minus 6V. A simple addition can be made to cater for this, as will be described.

Close regulation of the output voltage against changing load or varying mains voltage is regarded as essential for this work and has the added important property of keeping down the effective impedance of the supply unit as seen by the circuits being supplied. The present design has load regulation so good that it is almost impossible to measure with normal voltmeters. The change of output voltage from zero load to full load is no more than the thickness of the meter's pointer.

The total drain at either positive or negative terminal of an operational amplifier will not normally exceed 5 milliamps, and may be much less. Therefore the present design, which can supply up to 35 milliamps on each side, should take care of circuits using up to six or seven op-amps simultaneously without exceeding the safe load limits of the transistors employed and without need for heat-sinks.

The residual hum level which can be tolerated depends upon the type of circuit being supplied and upon its effective gain and bandwidth. The intrinsic gain of an op-amp is very high indeed and in practical circuits is always heavily reduced by negative feedback. Even so, gains of as much as 1000 times can easily be obtained from a single uA709 and can sometimes be usefully employed; in such a case low hum from the power supply is essential. Experiment suggests that a residual hum of one millivolt is satisfactory in most cases and the present design as it stands meets this requirement. If lower hum is desired it can easily be obtained at little extra cost, as later described.

To meet the requirements, therefore, the needed specification is:
Input: 230 / 240 volts, 1 Amp. (see text)
Outputs: Plus and minus 15 volts at 35 milliamps max.
Hum: Less than 1 millivolt RMS at full load; (proportionally less on lighter loads).
Regulation, no load to full load: Better than 0.1 pc
The design meets these demands.

As may be seen from the diagram, the two sides of the circuit are identical except for the transistors. The centre-tapped power transformer secondary winding supplies 15 + 15 volts to two full-wave rectifier circuits for the positive and negative supplies, using silicon rectifiers D1, 2, 3 and 4. These were type 1N4002 in the prototype but any 1 amp rectifier of peak inverse voltage 100 or more can be used. C1 and C2 provide sufficient smoothing, but can be increased in capacity if thought necessary, as discussed later.

The transistors used are inexpensive complementary types available from Fairchild Australia Ltd, housed in the T018 package and with a safe dissipation of 0.5 Watt in free air at 25C ambient temperature. As the normal full-load dissipation in this circuit does not exceed 0.25 watt there is a good safety margin. Type AY6108 is an NPN type and AY6109 a PNP; their characteristics are otherwise similar and both are of silicon planar construction with correspondingly good temperature leakage and drift characteristics. If desired, AY6108 can be replaced by the 2N2219, and AY6109 by the 2N2905, both available from Total Electronics Ltd or other Motorola distributors. These all have very similar characteristics.

Looking at the positive side of the circuit, Tr1 is a series-type regulator through which the whole of the regulated output current flows. This current flow is controlled by the voltage applied to Tr1 base, and this in turn is controlled by Tr2 through the voltage-drop across R1. Tr2 base is biased by the voltage drop across R5, due to the current through the 15-volt reference zener diode D5. If this diode current varies due to a change in load at the 15 volt output terminal, the voltage across R5 also varies and this change is amplified by Tr2. Its collector current therefore changes and alters the voltage drop across R1 in such a sense as to bias Tr1 in the proper direction to increase or decrease its emitter current as required by the changed output load. The output

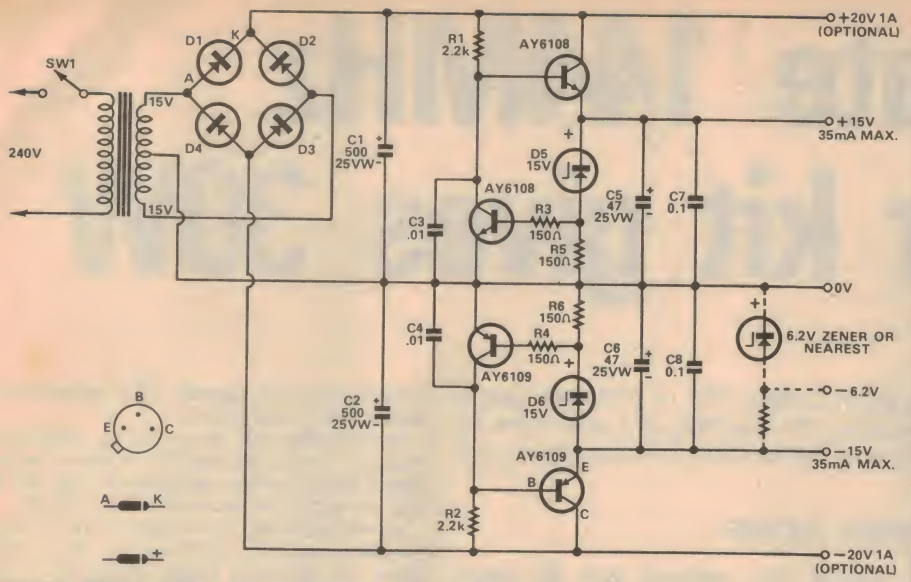
PARTS LIST

RESISTORS: ½ watt, 5 pc
R1 / 2 2.2k
R3, R4, R5, R6, 150 ohms
CAPACITORS:
C1 / C2 500 uF 25VW electrolytic
C3 / C4 .047 uF Mylar or paper, 100VW or higher
C5 / C6 47 uF, 25VW electrolytic
C7 / C8 0.1uF ceramic disc, 20VW or higher

SEMICONDUCTORS:
Tr1 / Tr2 AY6108 or 2N2219
TR3 / Tr4 AY6109 or 2N2905
D1, D2, D3, D4 1N4002 or larger (see test)
D5, D6 zener diodes, 15 volts, 400 mW

MISCELLANEOUS:
Transformer, 230 / 240 Primary, 15-0-15V Secondary, A & R Type 6672 or equivalent (see text) Sw1, single or double-pole ON-OFF switch, Veroboard or tag-strips, wire, machine-screws and nuts, case if used, plugs and sockets if used.

30 Back Beach Road, Portsea, Victoria 3944



NOVEL REGULATOR CONFIGURATION is used in both sides of the supply, to give very stable output despite the few components used. The power transformer may be a low current type if the 1A outputs are not required.

voltage, being determined by the zener diode, meanwhile remains almost unchanged. The negative side of the circuit behaves similarly but the positive and negative supplies react independently to load changes. C7 and C8 are ceramic discs serving as RF bypasses for stability.

The unit could, of course, be used as a single-sided supply of 30 volts of either polarity by disregarding the zero terminal and making the appropriate 15-volt terminal "earthy", but the need for this may seldom arise. The most likely case is where an op-amp is being used as an AC-coupled amplifier. It is possible in this case to work with a positive supply only, the negative supply terminal of the op-amp being grounded, but this requires extra components in the op-amp circuit and, in the author's limited experience, sometimes brings stability problems. It seems simpler and more reliable, in both AC and DC-coupled circuits, to use the op-amp with the standard arrangement of both positive and negative supply lines.

If a lower voltage on either side is needed for a particular op-amp, it can easily be provided by adding a further zener diode of the required voltage, in series with a suitable ½ watt resistor, across the appropriate 15 volt output, as shown dotted. Such an extra output should be limited to a drain of, say, 4 milliamps, which is sufficient for any likely single integrated circuit.

At the collectors of Tr1 and Tr3 there are available positive and negative supplies of approximately 20 volts, fairly well smoothed but not regulated. These can often be used successfully for the Class B output stages of, for example, a pair of stereo amplifiers with outputs of up to 15 watts or so per channel. The permissible average current drain will be controlled mainly by the rectifier diodes and power transformer used; with the suggested transformer a limit of around 1 ampere should be safe. However, in such a case it would be wise to increase C1 and C2 tenfold to around 5000uF, 25VW, and to substitute larger rectifier diodes such as the BY118 or BYZ13 to take care of the heavier surge and ripple currents of these capacitors.

No attempt has been made to incorporate overload current limiting in this design, as this would require more components and much larger transistors with heat sinks for Tr1 and Tr3. However, breakdowns causing serious overloads seem to be extremely rare in integrated circuits. Of course accidental short-circuits of the power supply should be guarded against — transistors are unforgiving creatures!

Not many power transformers suitable for this application seem to be available in catalogues; in fact, the writer could locate only one having suitable secondary voltage, namely the A&R filament transformer type 6672. This has a 30 volt secondary with several tappings, including one at 15 volts which becomes the centre-tap in the present design, the rest being unused. The current rating is 1 ampere, making it much larger than is needed if the unit is to be used only for IC's, but it becomes quite suitable if the 20 volt 1 amp outputs are to be used. The excess size has no electrical drawback and can only improve the regulation.

There is nothing critical about the construction, and a fairly small piece of Veroboard of 0.15 inch matrix will accommodate everything except the transformer. It is quite practicable to mount the circuit board onto the transformer itself, without using a case, but keeping the transistors at a reasonable distance from

(Continued on Page 105)

TABLE 1 Voltage and current analysis

Zener diode	
Current	4.2mA
Voltage	15V
Dissipation	0.063 Watt
Tr1 / Tr3	
Voltage, collector to emitter,	7V
Voltage base to emitter,	0.55V
Collector current	32mA
Dissipation	0.214 Watt
Tr2 / Tr4	
Voltage, collector to emitter,	16.5V
do base to emitter,	0.62V
Collector current	2.5mA
Dissipation	0.04 Watt

Solid state 144MHz amplifier kit gives 30W

If you're a keen radio amateur interested in 2-metre FM or CW, this article should be of interest. In it the author describes the assembly of a solid-state 30 watt RF power amplifier kit offered by one of our well-known advertisers, and reports on its performance.

by JAMIESON ROWE

Those readers who are also keen radio amateurs may have noticed that for some months now, Dick Smith Electronics has been advertising a family of three VHF power transistors, the 2N5589, 2N5590 and 2N5591. Made in the USA by Solid State Scientific, Inc. the three are intended especially for use in the final stages of FM and CW transmitters working in the VHF bands. Working from a nominal 12.6V DC supply, and in cascade, they will take a meagre hundred milliwatts or so of drive at 144MHz and boost it up to around 30 watts.

Being modern epitaxial planar silicon devices with distributed emitter sites and integral emitter ballast resistors, they are electrically quite rugged — capable of withstanding severe mismatch conditions under full drive. At the same time they feature a low-inductance stripline "capstan" package, which offers both improved electrical stability and more effective heatsinking. And perhaps the best news of all is that they are not nearly as costly as the early devices of this type: individually they range from $6.50 to $9.85 in 1-9 quantities, while Dick Smith Electronics has been advertising the set of three for $22.50.

Apparently the transistors have become quite widely used both here and in the US by manufacturers of mobile and marine radio gear. By repute they were also known to at least some amateurs, and no sooner had the adverts first appeared than the orders started coming in. It wasn't long after that before the reports came filtering back from happy customers, delighted with the results they were getting and the freedom from strife.

So numerous were the happy reports, in fact, that Dick Smith himself, also a licensed amateur (VK2ZIP), decided to build up a PA unit using the devices. He did so, and tried it out with one of the popular "Ken" hand-held FM transceivers. The results were so good that he decided there and then to add the project to his list of DSE "Superkits," or the kits which he feels are worthy of special treatment and emphasis.

At about the same time he rang me up, and asked me if I thought our readers might find the amplifier of interest as a project. When I replied that this did seem likely, he undertook to send over one of his kits "off the shelf," so that I could have a go at wiring it up. We both agreed that this would be the best approach, because I would then be able to report on the amplifier not just as a VHF power amplifier, but also as an example of DSE "Superkits," putting myself in the same position as a customer buying the kit over the counter.

Hence this article, which is thus both a report of my experiences assembling a "Superkit," and a report on the performance of the sample VHF power amplifier when assembled.

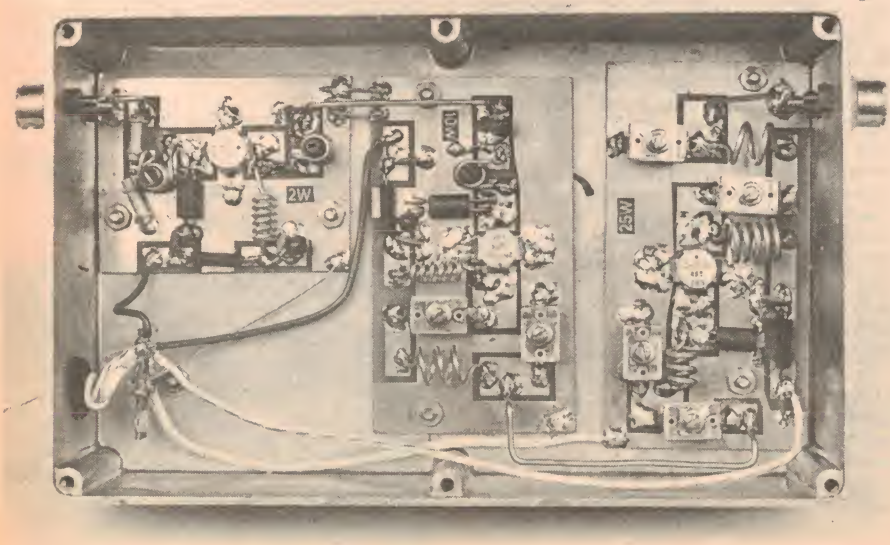
Incidentally, the price of the complete Superkit, which includes the printed wiring board and all minor components (but not a box, or cable connectors) is only $37.50.

Opening the kit when it duly arrived, my reaction was very favourable. All of the parts for the three stages appeared to be there (always a good start!). Not just the printed board, transistors and minor components like capacitors, trimmers and ferrite beads, but also the not-so-obvious bits like coil formers and slugs, generous lengths of the right gauges of wire for coil winding, and even three lengths of resin-cored solder. The solder was to prove more than enough, for those who may be caught short at 2 o'clock on Saturday afternoon!

In fact when I set out the parts carefully before tackling the assembly, I found only one thing missing: the three little lengths of rubber thread needed for locking the cores in the Neosid coil formers. Luckily I had a few left over from a previous project, so that there was no harm done.

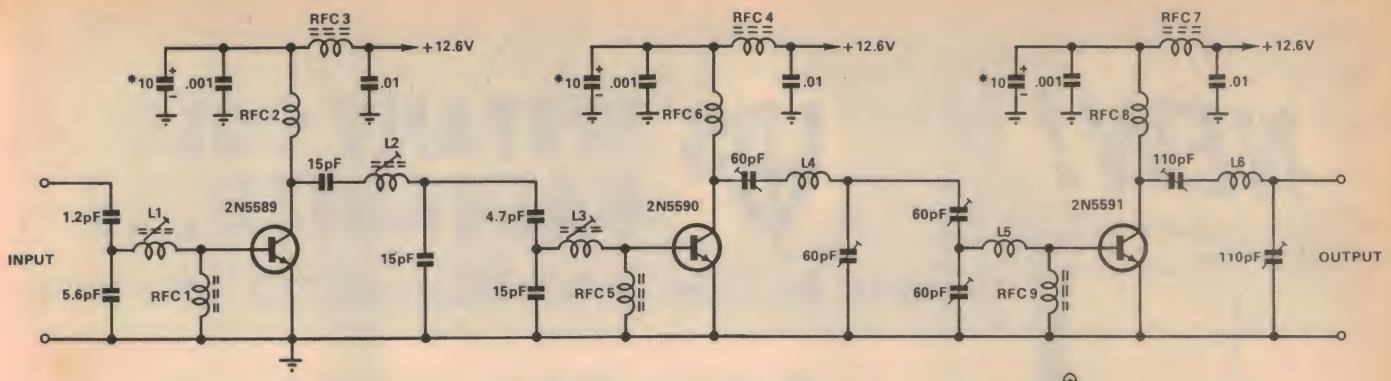
On examining the notes supplied with the kit, I found that they are concerned mainly with the main essentials. They give all the basic details concerning coil winding, component placement and wiring, and adjustment for correct operation. However, they don't give a great deal of guidance concerning the actual assembly of the unit, so that in this respect I had to rely on past experience.

One thing the notes did make clear, however, was that the transistors would need adequate heatsinking. This applies particularly to the third stage. The prototype unit pictured in the notes (also

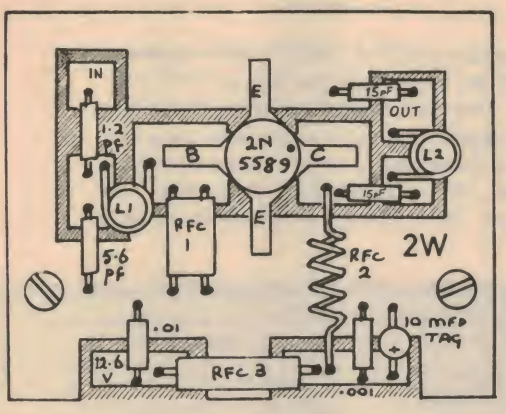


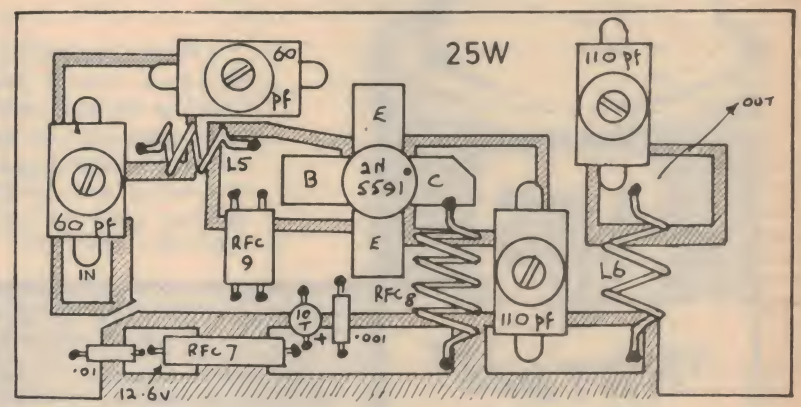
EXTERIOR view of the amplifier as built by the author. There are only three external connections: DC power input, RF input and RF output.

INTERIOR of the author's version of the 144MHz amplifier is shown at left. The aluminium die-cast case also serves as the heatsink for the power transistors, making a neat and compact little unit.

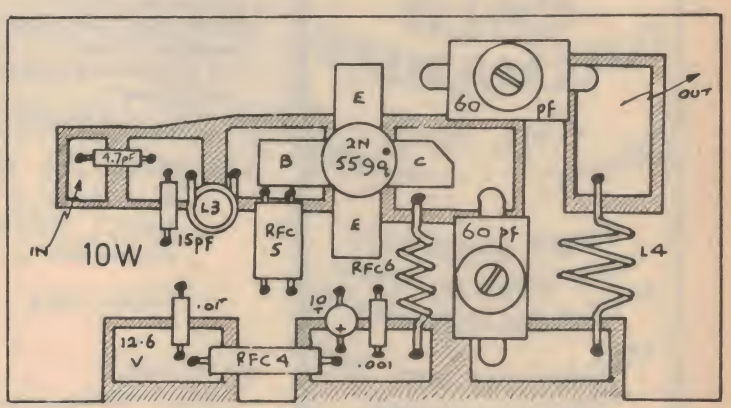


SOLID STATE 144MHz POWER AMPLIFIER





COMPLETE CIRCUIT of the amplifier is shown at top of page, while the wiring details of the three stages are shown above and at right. Full winding details for all the coils and RFCs are given in the box below.



shown here) was apparently built up on a length of U-shaped aluminium extrusion, measuring 2½ x 1¼in in cross-section. While this no doubt would serve the purpose, I didn't find it very appealing in terms of compactness or visual appearance.

After a little head-scratching I came up with the fairly obvious solution visible in the other photographs. The long printed wiring board is cut into three, separating the three stages, and these are then mounted inside an aluminium die-cast box which also serves as the heatsink. The box is one from the Eddystone range, and measures 187 x 120 x 57mm, but there is a similar box in the STC range which should be equally suitable.

Upon getting the box, I cut up the board and proceeded to work out the layout least likely to cause spurious coupling between stages. This done, the obvious step was to mark out, and drill all the mounting holes in the boards and the box. It was then that the next little problem appeared.

The notes supplied with the kit do not go into detail regarding the actual mounting of the transistors, confining themselves to the statement that ". . . In all cases the mounting stud of the transistor must make intimate contact with the heatsink." For anyone like myself who had not previously used transistors in the "capstan" package, this still left the precise method of mounting anything but obvious.

Again, there was a certain amount of head-scratching, until I came up with what I have since discovered is the right answer. This involves drilling a pilot hole in each board at the centre of the transistor location, and reaming out the hole carefully until the body of the transistor will just drop through. The copper areas immediately surrounding the hole are then cut back slightly with a knife or razor blade to prevent the possibility of them shorting to the base of the transistor when the two are mounted in the box.

At this stage the boards can be held inside the box in their appropriate positions, and the positions of the board mounting holes marked using the holes already drilled in the boards as a guide. Incidentally it is necessary to drill a second mounting hole in the output stage board near the RF input pad, as the copper pattern shows only a

COIL WINDING DETAILS

L1, L2: 4¾ turns 20SWG tinned copper wire, spaced to ⅜in long on Neosid 722 / 1 former with F29 slug.

L3: 2¾ turns 20SWG tinned copper wire spaced to ⅜in long on Neosid 722 / 1 former with F29 slug.

L4: 3 turns 20SWG tinned copper wire air cored, wound on 5 / 16in dia. mandrel and spaced to ⅛in.

L5: 3 turns 16SWG tinned copper wire air cored, wound on 3 / 16in mandrel and spaced to ⅜in.

L6: 2 turns 16SWG tinned copper wire, air cored, wound on 5 / 16in mandrel and spaced to ½in.

RFC1, RFC5, RFC9: Two parallel tinned copper wire, threaded through adjacent holes of a Philips ferrite bead No. 4312 / 020 / 31550.

RFC2, RFC6: 6 turns 20SWG tinned copper wire wound on ⅛in mandrel, spaced to ½in long.

RFC3, RFC4, RFC7: Single tinned copper wire through Neosid F29 tuning slug.

RFC8: 5 turns 16SWG tinned copper wire wound on 5 / 16in mandrel and spaced to ½in long.

(Twist drill shanks make good mandrels for winding the air-cored coils.)

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LPS Instant Cold Galvanize is NOT A PAINT! When applied to iron or steel it generates a positive electric current that flows to the base metal. This electrochemical action fuses the zinc compound with the metal. Corrosion will attack only the outer zinc coating leaving the metal to be protected rust free. If coating is penetrated LPS Instant Cold Galvanize will sacrifice itself to protect the exposed base metal. RUST CANNOT SPREAD.

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LPS Instant Cold Galvanize should be used wherever metal is exposed to corrosive conditions such as in the construction and maintenance of:

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FARMING EQUIPMENT	WATER TANKS	FENCING
MARINE EQUIPMENT	MOTOR BIKES	OIL RIGS & PIPE LINES
METAL ROOFS & FLOORS	TV AERIALS	STRUCTURAL STEEL
MINING EQUIPMENT	SNOWMOBILES	LINES & TOWERS
OFF-SHORE STRUCTURES	GOLF CARTS	UNDERGROUND EQUIPMENT
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AIR CONDITIONING, HEATING, & REFRIGERATION SYSTEMS

TECHNICAL INFORMATION:

Passes PREECE TEST for hot-dip galvanizing
SINGLE APPLICATION THICKNESS – approximately 1½ mils
COVERAGE – approximately 50 square feet per pound

TOUCH DRY – 1 minute . . . can be painted over in 6 hours or 30 minutes after baking at 350° for 15 minutes

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- Over 3,000 hours in salt spray cabinet
- Water temperature above boiling point
- Continuous dry heat up to 750° F.
- Short period heat up to 1000° F.

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MIL - P - 21035 Galvanizing repair (U.S. Navy)
MIL - P - 26915A for steel (U.S. Air Force)
MIL - T - 26433 for towers (Temperate and Arctic Zones) (U.S. Air Force)

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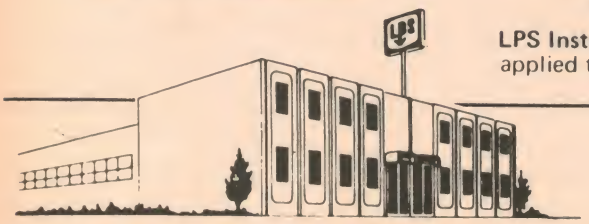
LPS Instant Cold Galvanize provides maximum protection when applied to clean, dry metal.



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single hole position at the other end.

The board mounting holes can now be drilled, together with those for the co-axial connectors and the DC supply cable. And after all holes have been de-burred carefully, the boards (still unwired) can be temporarily mounted in the case to allow accurate marking of the case at the exact centres of the large reamed-out transistor holes. The boards should then be removed, and small holes (say ⅛in or 3mm diameter) drilled in the three marked positions. Then, using one of the transistors as a guide, each hole should be carefully reamed out until it is just a clearance fit for THREADED STUD of the transistor. Again, the reamed holes should be carefully de-burred, to ensure that the body of each transistor will ultimately be in intimate contact with the case.

Just in case all this is not clear, and so that you won't have to work it out the hard way too, the final mounting arrangement is shown in the diagram. This should make clear the reasons behind some of the stress in the foregoing description.

There is still one step which should really be done before the actual wiring of the boards. This is the mounting of the small Neosid coil formers to the boards for the first and second stages.

I don't know the exact mounting method for these formers recommended by the manufacturer, but I mounted them in the following way, and it seems to work. First, I drilled a small hole in each of the three positions indicated by the board patterns, and then carefully reamed the holes out until they appeared close to a neat fit for the keyed bases of the formers. Then with a small rectangular jeweller's file, I filed small notches out from the holes to clear the former keys.

Finally the three formers were cemented into the holes, using Araldite epoxy cement, and the two boards concerned carefully placed out of harm's way for 24 hours to let the cement cure. Meantime, I wound the various coils, using the wire supplied and according to the instructions which are also shown in the table. It was also possible to wire up the third stage board, as this does not involve any coil formers (the coils are all self-supporting, and with no slugs). I used the shanks of appropriate sized twist drills as mandrels for winding the air-cored coils and RFCs.

Note that the transistor is not wired in circuit at this stage, but is left until the board is mounted into the box. This applies also to the other two boards, which may be wired up also when the cement has cured.

When the boards are wired, they are mounted into the box, and the various interconnections made. I used some of the excess stout tinned copper wire supplied in the kit for the RF interconnections, stretching it first to make it more suitable for bending into shape. The DC supply wiring was made in stout plastic-covered multistrand hookup wire (actually a length of plastic figure-8 flex split apart). Finally the transistors were mounted in position, orientated with the indexing dot facing the collector pads of the patterns. First the mounting nuts were carefully tightened, and then the four connecting tabs soldered to the board pads.

With the complete amplifier now assembled, the next step is to feed it with DC and drive, and tune it up. The requirements are a suitable power supply capable of delivering a nominal 12.6 — 13.8V DC at up to about 4 amps (or alternatively a well-charged car battery), a small transmitter or exciter capable of generating a drive of at least 100-120 milliwatts at 144MHz, and a dummy load fitted with a power measuring facility. The notes supplied with the kit suggest that the load/power meter should be of 50 ohms impedance, but a 75 ohm load will be appropriate if this is to be the impedance of the aerial to be used. The matching circuit of the output stage is capable of being tuned for either impedance.

I used my trusty "VHF Powermatch," described some time ago, with which many readers will be familiar. This has adequate sensitivity for the job, and although it will only indicate up to 30 watts, it will still allow satisfactory tuning of the final stage if the supply voltage to the amplifier is kept below about 13V.

Basically the amplifier stages are tuned up in cumulative fashion, starting first with the low power stage, then adding the second stage, and finally the "afterburner."

Power is temporarily disconnected from the second and third stages, and the input of the second stage disconnected from the output of the first. In its place is connected the dummy load / power meter. With drive and power applied to the first stage, the slugs are then tuned for a peak in output. In my case this amounted to about 2 watts.

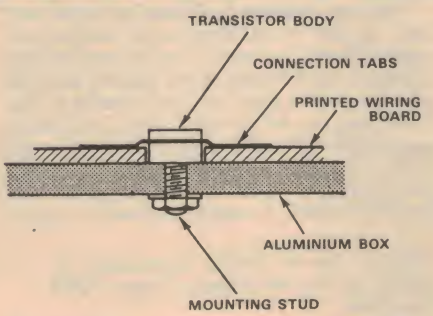
At this point it is a good idea to check the stability of the stage, by disconnecting the RF drive. The output should fall to zero! If it doesn't, the idea is to re-adjust the coil slugs until this is achieved, without sacrificing more than an absolute minimum of output. It can be done, but in my case it took a few attempts.

When the first stage is peaked up, the second stage can be connected back to the supply, and its input reconnected to the first stage output. The power meter is connected now to the second stage output — temporarily replacing the third stage input — and drive and power re-applied. The input coil slug and output trimmers are then adjusted as before, for a peak in power output. It may be necessary to touch the output slug of the first stage, in order to achieve the best result, but don't adjust it very far, or you may undo the good work and have to go back and start over again. In my case the second stage output peaked at around 10 watts.

The final step is to connect up the final stage, and adjust its four trimmers for a peak as before. Here the notes supplied with the kit stress that for stability, the series input trimmer should be kept set to between a half and a third of the shunt trimmer capacitance (not an easy thing to judge!), but I found that in my case this stage showed no tendency to take off even with the two almost equally screwed in.

With a supply voltage of close to 12.6V, the sample unit gave almost 25 watts of RF "steam," and this would no doubt climb to well over the 30 watts if the supply were increased to the 13.8V upper limit.

Of course, with transistorised RF power amplifiers it is not just a matter of achieving the desired power output level. There is also the matter of ensuring that the output is free from spurious emissions — not just harmonics, either. As many amateurs (including myself) have found to their embarrassment, RF power transistors are quite capable of generating all sorts of weird and wonderful signals along with the one which they are supposed to be delivering! Undesirable, to say the least.



PROTOTYPE amplifier built up by Dick Smith Electronics is shown above, to illustrate alternative physical format. The diagram at left shows the way in which the power transistors are mounted

It was with this possibility in mind that I put the sample unit through a fairly rigorous series of tests using tunable wavemeters, the VHF Powermatch with a CRO connected to the output of its dummy load detector, my 144MHz receiving setup, and a solid-state TV receiver operating at the end of the bench. Past experience has shown that this last-named piece of "test equipment" is capable of showing very quickly whether or not a rig is producing spurious output.

The final test was to connect up the unit to a two metre aerial, and seek a critical report from a fellow amateur.

The result of all this cautious testing is that I can confidently give the Dick Smith "2 Metre PA Superkit" a clean bill of health. Not only does it deliver the power output claimed, but it also seems quite stable and free from nasty side emissions.

In short, then, I can fully recommend the kit to any amateur who would like to build up a solid-state 30-35 watt power amplifier for an existing 144MHz CW or FM rig. The logical question now is whether DSE will follow up the kit with companion kits for 6 metres and 432MHz. How about it, Dick?

Mini-fi: for stereo 'phones

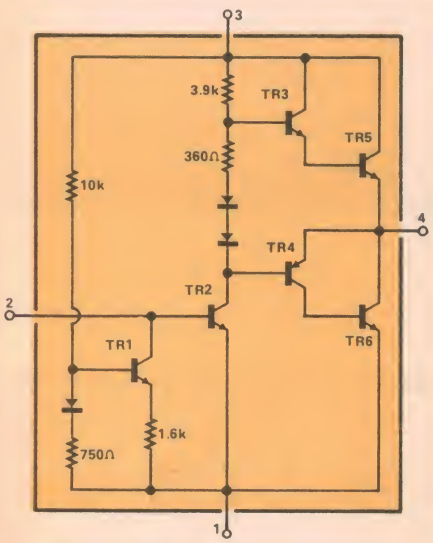
Here is a design for a bare-minimum stereo amplifier for headphones, designed around the Motorola MFC4000 "functional IC" device. While it uses only a handful of components and may be built at very low cost, the performance is surprisingly good.

by BRIAN WOODWARD*

Integrated circuit technology has progressed over the last five years at an alarming rate but mainly in the field of complex circuitry where the obvious advantages of multi-component integration can be fully exploited. Rarely do integrated circuits lend themselves to "tinkerers" or to very basic applications without wasting a great part of the devices' potential. However, the Motorola MFC4000 general purpose AF amplifier is almost a gift to the casual hobbyist.

The specifications of the device are much more impressive than its diminutive appearance. It is a four pin package, the case being only 7mm at its longest and weighing 0.25 gram. So it is indeed a tiny integrated circuit, only slightly larger than a single transistor.

For all this it is a six transistor general purpose AF amplifier, with a maximum output of 250 mW RMS and a modest power consumption of 60 mA (max) with only 3.5 mA standby drain. It has an impressive 0.7pc distortion at 50 mW rising to 4pc at 250 mW with a 9V DC supply. For normal uses the amplifier's slight distortion handicap over true hi-fi devices is unlikely to be more than that of the speaker being used.



INSIDE the MFC4000 functional IC, which forms the heart of the Mini-fi amplifier.

But by far the most impressive features of the MFC4000 are its price, and the fact that as few as four discrete components are needed to construct a working quarter watt amplifier. At a retail cost of around one dollar from Total Electronics, the MFC4000 can offer a substantial saving in the construction of a small general purpose amplifier, the main saving being in the transformers and extra transistors needed to construct a conventional small power amplifier. It operates with a transformerless output into a 16 ohm load but will run quite happily into 8 ohms.

The Mini-Fi project started because the author is a compulsive TV addict and after twelve years away from school found himself unable to study on returning home from tech if the insidious "box" was on. Everything was tried, firstly by ignoring the TV. When that proved impossible, I then tried playing the family hi-fi through headphones, but the the TV could still be seen as it was in the same room.

This was avoided by fitting an extra long lead on the headphones and studying in another room, but each time the record was changed the TV had to be passed and the lure invariably won. So it was decided, that by buying one of the small and very cheap turntables currently available from many of the advertisers in Electronics Australia, and making a minute stereo amplifier with two MFC4000's, I would construct a small, lightweight and very cheap headphones-only record player.

Many compromises have been made in the construction and design, mainly cost compromises. Disposals printed circuit boards were used, one for each channel, costing only 10c each. Slight modification was needed to accept the components but Veroboard would be eminently suitable for the task.

As the MFC4000 device itself is so small it became something of a challenge to make the amplifiers as small as possible and take full advantage of the space savings possible — even though there is usually enough room underneath a turntable for a much larger and less stringently compact design. The Volume controls used were 10k pre-set pots that were glued with Araldite directly onto the back of the front control panel, leaving just enough of their ¼" shafts projecting to take very small control knobs. The PC boards were then soldered directly onto the pre-set pot tags. Layout is not critical but a pair of long nosed tweezers will be essential to act as a heat sink when soldering the MFC4000 in place. The huge 1 watt 10k feedback resistor was necessary because of a current shortage of this and several other value resistors.

The appearance of Cx would at first appear strange. In construction the amplifier was found to have such a good potential quality that the crystal cartridge supplied with the cheap tone arm was the weak link in the chain. Replacing this with a Philips ceramic unit that was otherwise unused proved this, but to the detrimental reduction of response at the bass end. Even the best record sounded as though it had been well rubbed with coarse wet-and-dry sandpaper.

It was obvious that the higher frequencies would have to be cut or muted, to rebalance the response. With different cartridges the value of Cx changed considerably and for the Philips ceramic unit 0.1 uF polyester caps were found, by trial and error, to give the best results.

The reason for "tinkering" with the response of the amplifier at this point has a

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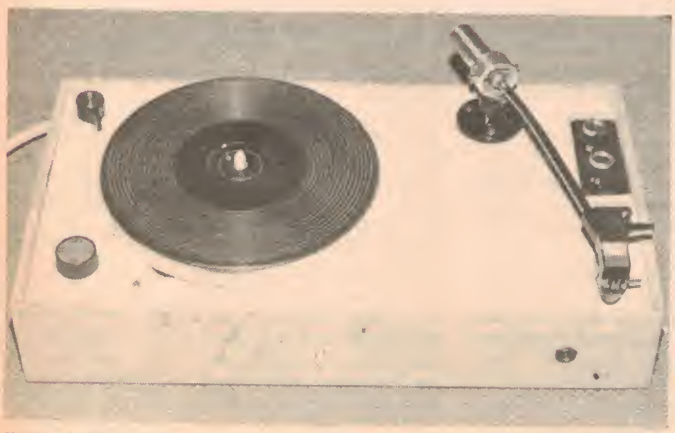
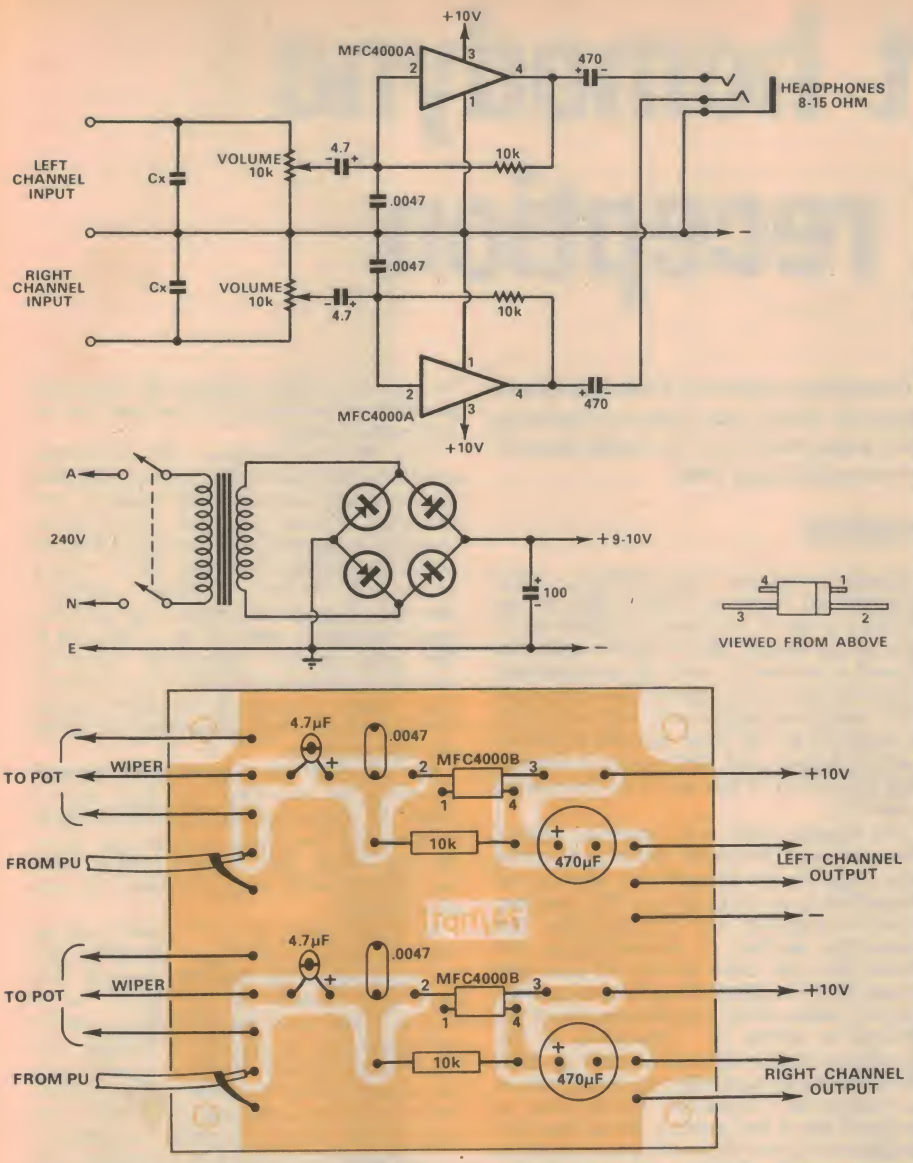


THE AUTHOR'S prototype unit, which combines two Mini-fi amplifiers with a low-cost turntable.

CLOSE-UP VIEW of one of the prototype amplifiers, which are supported by the preset pot lugs.



COMPLETE CIRCUIT of the headphone system is shown at top, with a suggested stereo board pattern and layout shown above.

two-fold purpose. Firstly, if the value of Cx is to be found by trial and error, to continually replace a feedback network on such a tiny PC board can be tedious. Secondly, the volume control now takes over the additional function of tone control. With a 0.1 uF capacitor, the lower levels of volume are fairly strongly muted whereas louder settings of the control also make the sound crisper, usually in keeping with the type of music that is played louder.

The power supply need not be large as the drain, even on peaks, is unlikely to exceed 120 mA.

On the prototype a miniature bell transformer was used with the 8V tap being rectified. A bridge is used for rectification as the inherent low noise of the amplifier shows up any stray 50 Hz hum very quickly. The amplifiers seem to run quite happily on any voltage between 7.5 and 12V without any ill effect.

The ceramic cartridge used is of the low output variety and yet power output from the amplifier is quite adequate for all but the most masochistic of listeners. The amplifier has also been run open circuited on a number of occasions with no ill effects.

Even using cheap headphones, which has kept the overall cost of the project extremely low, the sound reproduction is quite creditable.

MINI-FI PARTS LIST

SEMICONDUCTORS
- *2 MFC4000B integrated circuits*
- *4 100 mA diodes*

CAPACITORS
- *2 4.7uF / 9VW electrolytic*
- *2 470 uF / 9VW electrolytic*
- *1 100uF / 9VW electrolytic*
- *2 .0047 uF polyester*
- *2 Cx (see text)*

RESISTORS
- *2 10k 10pc ½ watt*
- *2 10k pre-set (log) potentiometer*

MISCELLANEOUS
- *1 240V 9V power transformer (150mA)*
- *2 Printed circuit boards or Veroboard to suit.*
- *2 control knobs*
- *1 1 turntable with tone arm and cartridge mains cord, plug, hook-up wire, shielded cable, etc.*

Low cost homodyne for local reception

Here is another AM radio tuner using the homodyne method of demodulation. Developed in our own laboratory, it is easy to build and uses components which should be readily available. While not presented as a "no holds barred" design for the serious music lover, it performs surprisingly well.

by IAN POGSON

When the Homodyne tuner was first described in June and July last year, it captured the imagination of many readers, due in some measure to the different techniques involved, but also to the remarkably low level of distortion and its simplicity. Unfortunately, no sooner had it got off the ground, when a shortage of the Motorola MC1330P IC made it difficult if not impossible to assemble a complete kit of parts. I understand that there have been limited numbers of these ICs more recently.

As soon as the shortage of ICs was known to us, we discussed the possibility of using another IC. The search for a direct replacement was quite fruitless, in that there seemed to be no other IC of the type concerned which broke the connection between the clipper and mixer circuits. In other words, this connection was not brought out to terminating pins to allow introduction of the tuned circuit which seemed to be a necessary part of the design. There were quite a number of what appeared to be otherwise quite suitable ICs and so we started to rethink some of the details around the tuned circuits.

We reasoned that perhaps it was not really necessary to have a tuned circuit between the clipper and the mixer, provided we had sufficient overall selectivity to avoid adjacent channel interference. This sounded all right in theory and so we decided to see if the theory worked out in practice. A simple TRF version was lashed up and it seemed to work out as expected. However, I was not satisfied that the simple TRF tuning arrangements were sufficient to separate all the local stations in places such as Sydney and Melbourne. It seemed that the answer to this was to go to a simple superhet.

The change over to a superhet circuit involved very few extra parts and added very little to the complexity, and so we embarked on development of the simplest superhet possible and incorporating the homodyne method of demodulation. No sooner had this been sorted out than the author of the original design came up with another design which avoided the use of the difficult to obtain IC (published in the November issue). This presented us with the dilemma as to whether we would not be overdoing the homodyne theme over a period of only a few months. But as our new design was rather different from the other two, we considered that a wider choice for readers would not be a bad thing. So here it is.

Before we proceed with details of our version of the homodyne, it would perhaps be wise to briefly explain the homodyne principle of demodulation for those as yet unfamiliar with it.

Like the synchrodyne, the homodyne involves extraction of the audio modulation by a mixing process rather than by rectification. A local oscillator signal at the incoming signal frequency is mixed with the signal to produce an audio beat. This is sometimes called "exalted carrier" detection, because the added local oscillator signal effectively adds to the amplitude of the signal carrier component compared with its sidebands. The effect is thus of a very lightly modulated resultant signal, which tends to keep distortion low in the detection process.

But whereas the synchrodyne system generates its own local oscillator signal, which is locked to the incoming signal carrier, the homodyne derives this signal directly from the carrier itself. This completely avoids any problems of synchronisation.

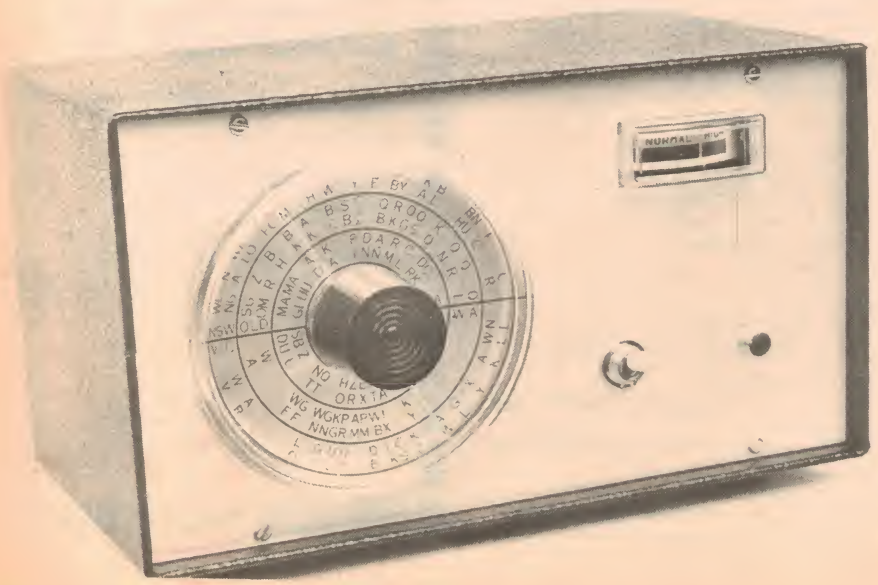
In order to get a suitable signal from the original signal carrier, the signal is split two ways before the detection process. One part goes directly to the mixer to be demodulated, while the other is stripped of its modulation by passing it through amplifiers and clippers. It is then injected into the second input of the mixer, whose output becomes the demodulated audio. This is all done in one integrated circuit component.

To see just how all this has been put into practice, let us take a closer look at the complete circuit. The first stage proper is the now familiar self-oscillating mixer, which we have used many times before. Preceding this stage is a standard aerial input circuit tuned to the incoming signal, and an FET whose purpose will be explained. Following the mixer is a pair of IF coils with capacitive top coupling.

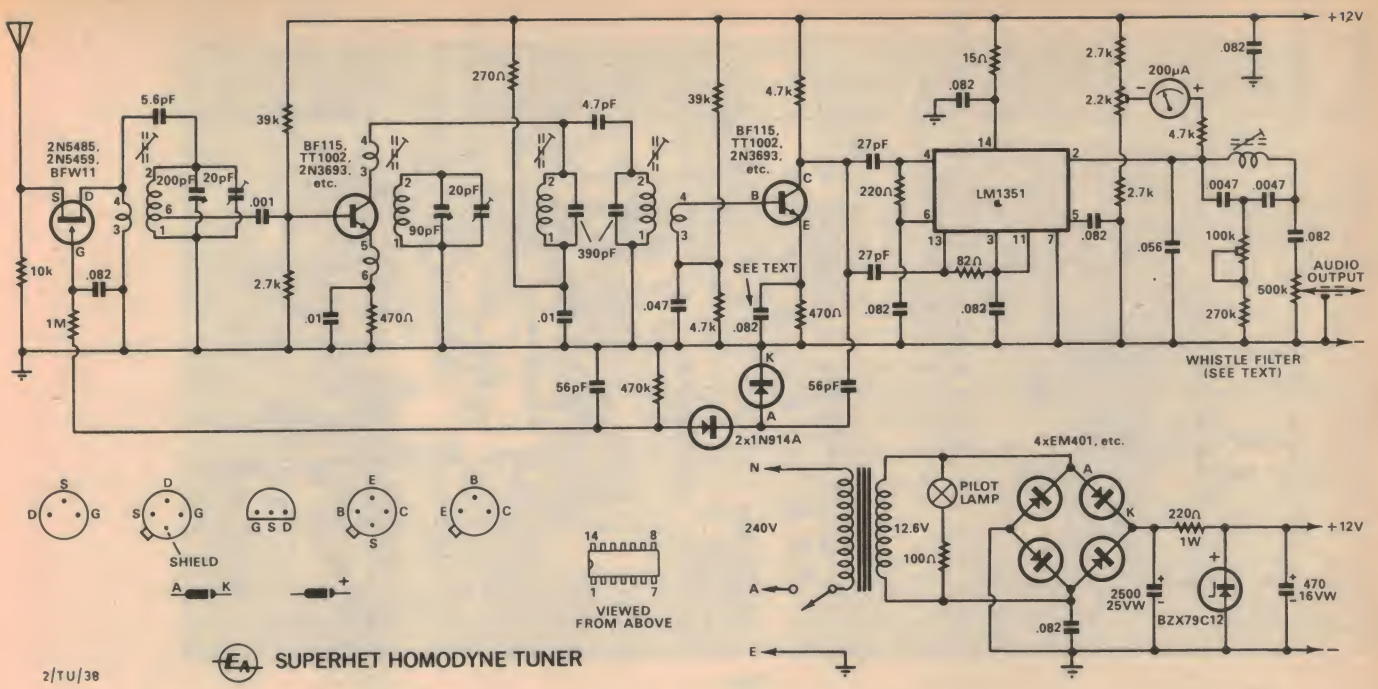
The nominal IF of 455kHz is amplified in the second stage by a conventional amplifier with a resistive collector load. Output from the IF amplifier is split two ways as explained before and each fed via a 27pF capacitor into the LM1351 IC. Audio emerges from pin 1.

Due to the bandwidth, 10kHz heterodynes or whistles, become a nuisance at night. Indeed, in many instances the 10kHz whistle would be so objectionable that it would ruin reception. Fortunately, this may be avoided with a filter, a "bridged T" filter tuned to 10kHz. This notches out the offending whistle.

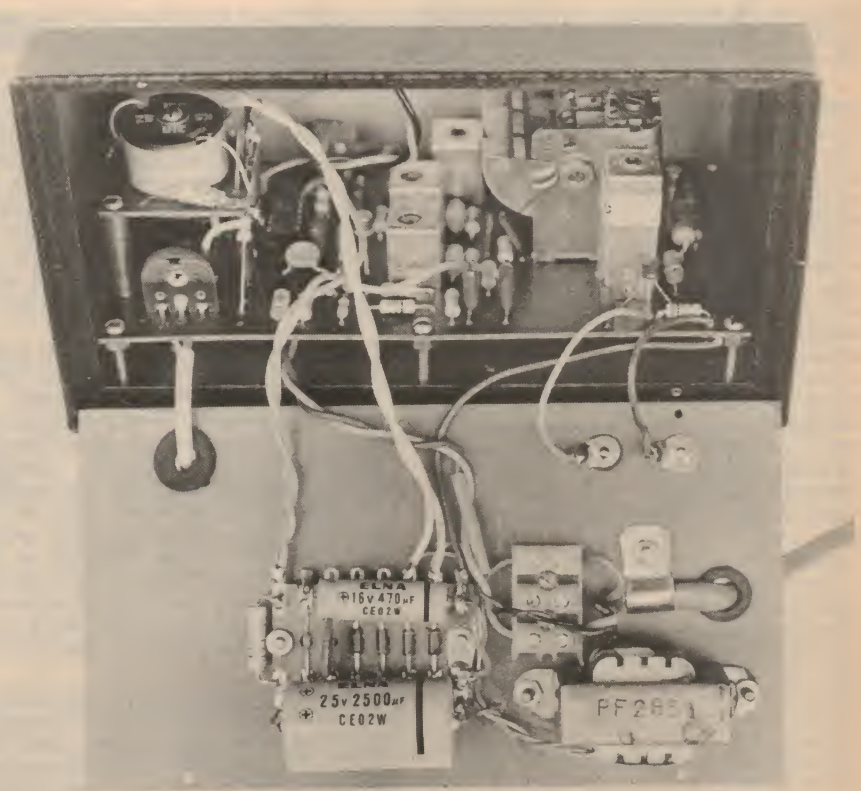
With such a simple overall system, there seemed to be limited possibilities for an effective AGC arrangement. After some



This picture shows the neat and simple arrangement of the prototype. The tuning control and dial, although of low cost, are quite acceptable for the lounge room.



The circuit above is described in detail in the text. The picture at right shows an interior view and the general disposition of major components.



consideration, we came up with the rather novel idea which may be seen in the circuit. Fundamentally, we have made use of the fact that a junction FET may be used as a variable resistor between source and drain, by applying a suitable bias to the gate. The bias is derived from a pair of diodes in a voltage doubler arrangement, rectifying some of the output of the IF amplifier. The negative voltage developed is in proportion to the signal strength and when applied to the gate of the FET, varies the resistance accordingly.

The source and drain of the FET are effectively in series with the aerial input; they are grounded to DC but are kept at a high AC impedance above ground for the incoming signal. When the resistance of the FET is varied by the bias applied to the gate, AGC action is achieved.

Although it is by no means essential, tuning can be made easier by adding a tuning indicator such as a meter. Pin 2 of the IC is the audio output and it also has about 6 volts DC at this point, and which rises in proportion to the level of signal fed into the IC. This may be used to actuate the tuning meter, which is incorporated between the IC and a few resistors which complete a bridge circuit. The no-signal zero of the meter is set with a 2.2k preset potentiometer and the meter reads forward on signals.

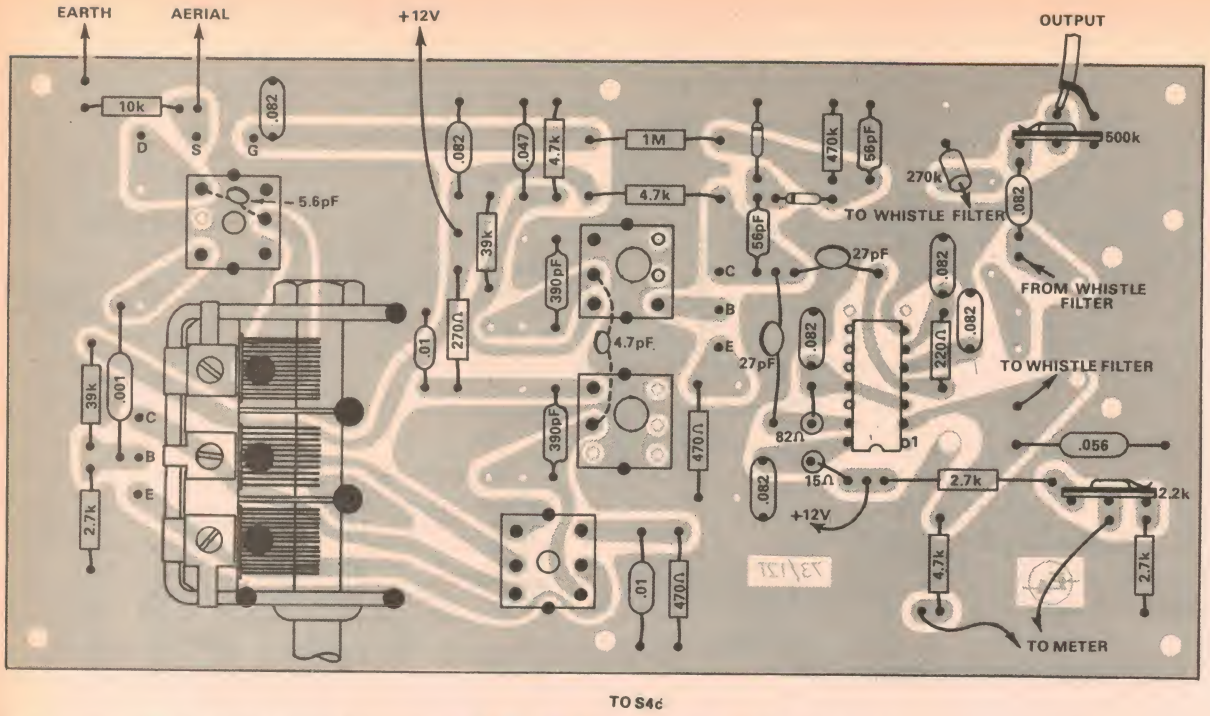
The power supply is a conventional design, delivering +12 volts DC regulated at about 25mA. A small transformer supplies about 12.6V AC to a bridge rectifier and the rectified AC is filtered by a 2000uF electrolytic. The voltage is then regulated to 12 volts with a zener diode and a further filter of 470uF. A .082uF capacitor bypasses one side of the transformer secondary to arrest any signals which may find their way via the power lines. The pilot lamp is also fed from the transformer secondary, with a 100 ohms resistor in series to ensure a long life for the lamp.

There should be no problem with components, but a few comments may be helpful. All resistors, except where stated otherwise, may be either ¼W or ½W. Capacitors in most cases are not critical except the .01uF capacitor shunting the 470 ohm mixer resistor, which should be adhered to. It should preferably be one of the polycarbonate types, although a ceramic type would normally be satisfactory.

It may be seen that we have used a number of .082uF capacitors and this reflects the state of the components situation at present. We used this particular value because we were unable to get 0.1uF at the time. If you have a choice, either value should be satisfactory.

The coils are conventional types which we have used in the past. However, whereas only one brand was available previously, at least one and perhaps two more manufacturers are now making a similar range. We have tried some of the new ones and there appears to be no difference in performance, so that they should be readily interchangeable. It should be noted however, that each manufacturer has his own type numbers for his range of coils. The parts list shows the numbers for two readily available brands.

The IF transformers, while they may be



The printed board is shown from the component side, with each item identified. The copper is shown "ghosted" to facilitate following the circuit. Wiring of the power supply panel is shown at right, which makes assembly of this item just as easy as the main board.

bought ready made, may also be wound quite readily. If you wish to wind your own, they are wound on Neosid type "E" adjustable inductance assemblies. The resonant winding consists of 130 turns of 36B&S enamel wire and the coupling winding on the second unit consists of 15 turns of the same wire, wound over the top of the other winding. Make sure that you terminate the windings, to correspond with the board. The start of each winding is connected to the "cold" or earthy side.

It should also be noted that the first IF transformer does not need the 15 turn winding. Another very important point is that the home wound coils need 330pF capacitors instead of the 390pF specified for the commercial types.

Before leaving the subject of coils, we have a choice of whistle filter coils and assemblies. One which has been available for many years, is the complete assembly made by RCS Radio and sold wired and adjusted. Our printed board has been made to accommodate this one. Another whistle filter coil has recently become available, originally the idea of Mr P. M. Stephenson, of Synchro-Tech Electronics. We understand that a complete whistle filter assembly is also being made available. The complete assembly or the coil separately, is available from Watkin Wynne and Synchro-Tech Electronics.

We have also made provision for the new coil on our board. As the inductance is quite different from the RCS unit, the two capacitors must be changed from .0047uF to .047uF. Also, the 270k resistor should be changed to 470 ohms or less and the 100k potentiometer should now be 1k. The board has been laid out so that all these differences can be accommodated.

We used a Roblan padderless 3-gang capacitor, although only two sections are used. This unit is available either with or without trimmers. The gang with trimmers may be used directly on the board but the unit without trimmers is somewhat cheaper and may be readily adapted by fitting two miniature Philips 20pF trimmers. The spindle may need to be shortened slightly.

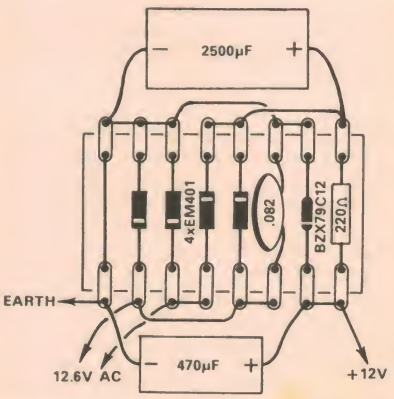
The box into which the tuner is fitted, is a commercially made unit manufactured by Australian Transistor Co and should be readily available. This is perhaps the easiest way to house the tuner, but other boxes may be available which would also be suitable.

Construction could start with the power supply. All components except the transformer are mounted on a piece of miniature tag board. It is only necessary to follow the wiring diagram to do this job. The transformer and a 3-position moulded terminal block for the mains, are mounted on the back panel of the box. This may be seen from the photograph. The power supply assembly is also mounted on the back panel. We used two ¾in long screws with extra nuts, to stand the assembly off the panel by ⅜in or so. A solder lug is used to tie the earth line to the case, via one of the screws.

The next and major job is to assemble the printed board. Reference to the diagram makes this task quite an easy one. We suggest that you place the small components, such as resistors, capacitors, diodes and transistors first. Then the larger items such as the coils, whistle filter and finally the gang are soldered in. Make sure not to overheat components when soldering. This applies particularly to the small items.

Due to some minor circuit changes since the board was drawn up and the unit assembled, it will be seen that there are some unused holes on the board. Also, the 5.6pF capacitor is mounted directly on pins 2 and 4 on the aerial coil, underneath the board.

As mentioned earlier, we provided for two different types of whistle filter on the board. If you use the RCS assembly, it is mounted on the board with two stand-off pillars. The input and output leads must be run from the



main board and the 100k potentiometer must also be connected back to the main earth copper on the board, via the 270k resistor. If you use the Synchro-Tech coil, then it will be mounted directly on the board, through the four holes provided. The two .047uF capacitors, the 470 ohm resistor and the 1k trimpot must also be added to the main board to complete the filter system.

Another important point is the correct fitting of the socket for the IC. The end corresponding to pins 1 and 14 will have a dot or recess moulded in and this end should be facing towards the front of the board. It may be seen that we have allowed for a 16 DIL socket; if a 14 pin socket is used, the two holes nearest the back of the board should be left vacant. When fitting the IC to its socket, make sure that the power supply is off. The recess or dot on the IC moulding must correspond with that on the socket. Care should also be taken to insert the IC carefully, making sure that all pins are entering the socket correctly.

The back panel is fitted with aerial and earth terminals, a rubber grommet for the mains lead and a grommet for the audio out lead, as may be seen from the photographs.

With the board, back panel and front panel completed, there are a number of leads which must be added so that the various parts can be interconnected on final assembly. These consist of wires for the aerial and earth terminals, tuning meter,

pilot lamp and mains on / off switch. When wiring the pilot lamp, we mounted the 100 ohm resistor right on the lamp terminal, using some insulation tape to prevent any possibility of a short circuit. In addition to the wires mentioned, a shielded lead is also fitted from the audio output point. The lead should be no longer than necessary, two feet or so, and a suitable plug will be needed to plug into the amplifier to be used with the tuner.

With the leads fitted as just described and before the unit is assembled into its box, testing and adjustments should be done. As the mains on / off switch could be a hazard, it should be carefully and adequately covered with insulation tape to prevent any possibility of a shock. After a careful check for any errors or omissions in construction, switch on and check the 12V supply voltage. Assuming that all is well, set the audio output preset pot to maximum Adjust the present pot for the tuning meter so that it reads zero. If you have an RCS whistle filter assembly, do not touch the pot on it at this stage.

If you have a signal generator, this will make the job of alignment quite an easy one. Set the gang fully closed and inject 455kHz into the aerial terminal of just sufficient strength so that a small reading is obtained on the tuning meter, or the modulation may be heard from the speaker. Adjust both IF coil slugs for maximum response. With the gang still closed, set the generator to 530kHz and adjust the slugs in the oscillator and aerial coils for maximum response. It may be necessary to reduce the signal generator output during these operations, to prevent excessive signal input. Set the gang to fully open, all but about 5 degrees, and reset the signal generator to 1600kHz. Adjust the trimmer on the oscillator section of the gang for maximum response, then adjust the corresponding aerial coil trimmer for maximum response.

Having gone through this routine once, it must be repeated at the other end of the dial, followed by a return to the high frequency end. This must be continued until adjustments are correct for both ends of the range.

If you do not have access to a signal generator, then it is possible to arrive at a reasonable alignment compromise without one. Firstly, tune in any strong station and adjust the slugs in the IF coils for maximum response. Then tune in a convenient station near the low frequency end of the dial and adjust the oscillator coil slug so that the station comes in where it may reasonably be expected on the dial. Then adjust the slug in the aerial coil for maximum response. Do the same towards the high frequency end of the dial, this time using the oscillator trimmer and then the aerial coil trimmer. At this stage you may temporarily fit the front panel, with the dial scale and cursor. This will enable you to check if the stations come in reasonably close to where they are marked.

Do not expect the stations all to come in exactly where marked. However, if you feel that some adjustment is necessary, then

(Continued on page 105)

PARTS NEEDED FOR THE HOMODYNE TUNER

1 Case, 18 cm x 10 cm x 10cm, with front and rear panels
4 Rubber feet for case
1 Jabel handspan dial and scale
1 Meter 200uA, type V303, EW5 or similar
1 Miniature toggle switch, SPDT
1 Indicator lamp 14V type BFB-6G (Rodan)
2 Terminals, 1-red, 1-black
2 Rubber grommets
1 Printed wiring board, code 73 / 12t (162 x 83mm)
1 Miniature tagboard, 8 prs tags
1 Plastic terminal block, 3-way
1 Transformer, 240V primary, 12.6V 150mA secondary
1 Whistle filter, RCS (or 1 Synchro-Tech coil with capacitors and resistors as in text)
1 Aerial coil, 7155, S203
1 Oscillator coil, 7348, S201
2 455kHz IF transformers, 9185, ST45C
1 Ceramic filter, BF-455A (see text)
2 Brass spacers, 1in long, tapped ⅛in Whitworth
1 Transistor, 2N5485, 2N5459, BFW11
2 Transistors, BF115, TT1002, 2N3693
2 Diodes 1N914A or similar
4 Diodes, EM401 or similar
1 Zener diode, BZX79C12
1 IC, LM1351
1 14-pin DIL socket

Resistors (¼W or ½W unless stated otherwise)
1 15 ohms
1 82 ohms
1 100 ohms
1 220 ohms
1 220 ohms 1W
1 270 ohms
2 470 ohms
1 2.2k trimpot
3 2.7k
3 4.7k
1 10k
2 39k
1 1k trimpot (see text)
1 270k (or 470 ohms, see text)
1 470k
1 470k trimpot
1 1M

Capacitors
1 4.7pF NPO ceramic
1 5.6pF NPO ceramic
2 27pF NPO ceramic
2 56pF 630V polystyrene
1 Roblan padderless gang, 200pF-90pF-200pF
1 .001uF 630V polystyrene
2 .01uF 100V greencap
1 .047uF 100V greencap
1 .056uF 100V greencap
1 470uF 25VW electrolytic
1 2000uF 25VW electrolytic

Miscellaneous:
Hookup wire, coax cable, solder, solder lugs, 3-core flex and plug, cable clamp, screws, nuts.
Note: Resistor wattage ratings and capacitor voltage ratings are those used for our prototype. Components with high ratings may generally be used, providing they are physically compatible. Components with lower ratings may also be used in some cases if available, providing ratings are not exceeded.

Synchronisation of taped sound with home movies

In this, the third and final article of our series on tape synchronisation with home movies, the author presents theoretical and constructional details for three different discriminating control systems and two different integrating control systems. Sufficient information is given to allow the reader to construct the unit best suited to his individual requirements.

by N. LABORDUS*

The basic principles of a discriminating control system were given in Fig 4 of the November issue. Synchronisation is achieved by introducing a neutral zone between two set points, situated on either side of the tape reference speed. The controller will then maintain the speed of the projector within this neutral zone.

The simplest practical version of a discriminating control system is shown in Fig 9. This unit is similar, in many respects, to the non-discriminating control system detailed in Figs 6 and 7 in the December issue. However, instead of the projector microswitch unit having two on / off positions, as for the previous case, there are now four on / off positions. Note that the tape recorder microswitch unit for the discriminating control unit is identical to the one used in the non-discriminating control system.

Full synchronisation between tape speed and film speed is obtained whenever there is effectively a 180 degree phase difference between the on / off switching cycles of the two microswitch units. In other words, switches S1 and S2 must be deactivated while ever switch S3 is activated, and vice versa.

During full synchronisation, relays Ry1 and Ry2 remain deactivated, resulting in a short circuit condition across the motor series resistor R2. If, however, the projector slows down, the relative phase of the projector switches is retarded, and S3 is activated before S1 is deactivated. This results in relay Ry1 being activated for a short time interval during each revolution, creating a short circuit condition across resistor R1 and speeding up the projector

*1 Priestly Close, St Ives, NSW 2075.

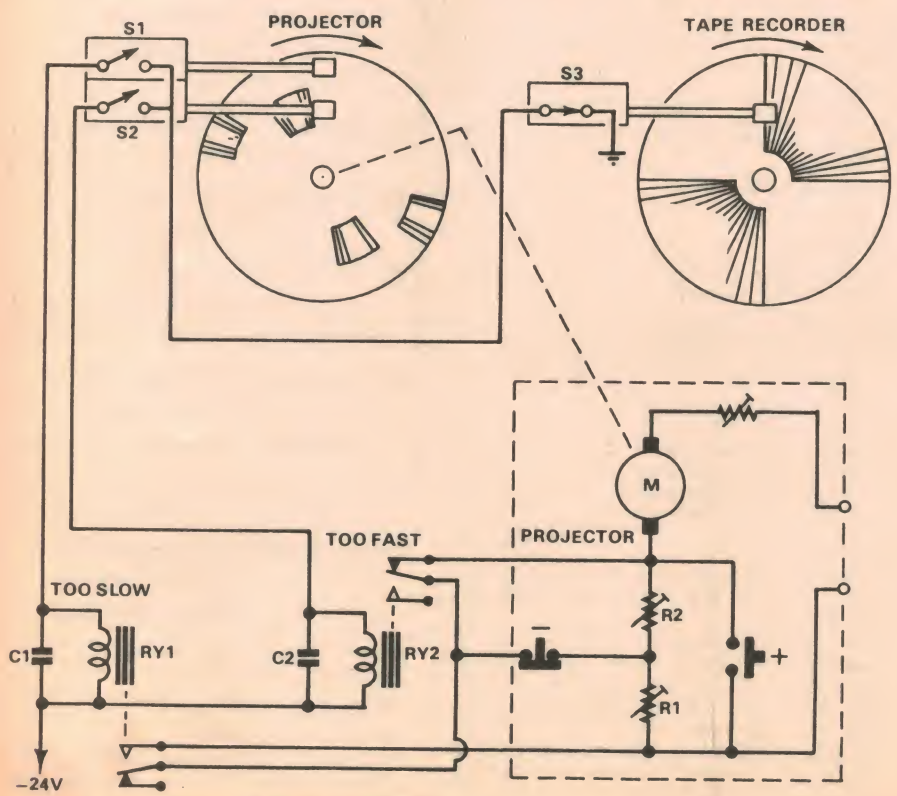


Fig 9: the circuit diagram of discriminating tape length synchroniser.

On the other hand, if the projector motor speeds up, S2 will be activated before S3 is deactivated, causing relay Ry2 to switch R2 into circuit and slow down the motor. The activation times of the relays are dependent upon the values of capacitors C1 and C2 which are connected in parallel across their respective relays.

As was the case for the non-discriminating control system described last month, the discriminating control system described above can be modified so that the actual tape contents are used as a sync reference instead of the tape length. The advantages conferred by using this method were discussed in the December issue, and are valid for both discriminating and non-discriminating control systems. Note that a stereo tape recorder is required to enable the tape contents to be used as a sync reference.

A practical version of a tape contents discriminating control unit is shown in Fig 10. This unit derives its synchronisation pulses from a 4kHz oscillator which is pulsed by modifying the projector microswitch unit as shown in Fig 10. Sync pulses are recorded on the tape by simply switching the unit (and the tape recorder) to the record position and simultaneously starting the projector and the tape recorder. In the playback mode, the sync pulses from the tape recorder are amplified and, after rectification, fed to a DC amplifier which activates relay Ry3. The remainder of the circuit functions as for the circuit described in Fig 9.

The AC amplifier, rectifier, and DC amplifier are identical to the circuitry (TR1, TR2, TR3) used in Fig 8 of the December issue, as is the 4kHz oscillator (TR4) and the power supply circuitry. Various other features of the circuit shown in Fig 8 may also be incorporated into the circuit shown in Fig 10, including automatic projector start, and mounting the sync disc on the projector operating shaft.

Another version of a tape contents discriminating control system is presented in Fig 11. This unit differs from the one shown in Fig 10 in that the microswitches have been replaced with photoelectric devices, and the rotating disc assembly now employs cut-outs instead of raised platform areas. The LED driver and photodetector circuits are presented in Fig 12. LEDs have been chosen in preference to glow lamps because they may be driven directly by transistors, and because glow lamps may introduce intolerable time delays into the circuit.

In the record position, pulses from the LED / photo transistor pair 3 cause relay Ry3 to switch on and off, thus allowing sync pulses to pass to the tape recorder. On playback, sync pulses from the tape recorder are fed into an LED driver circuit to modulate LEDs 1 and 2. These two LEDs, together with their associated driver circuit, disc cutouts and photodetector cir-

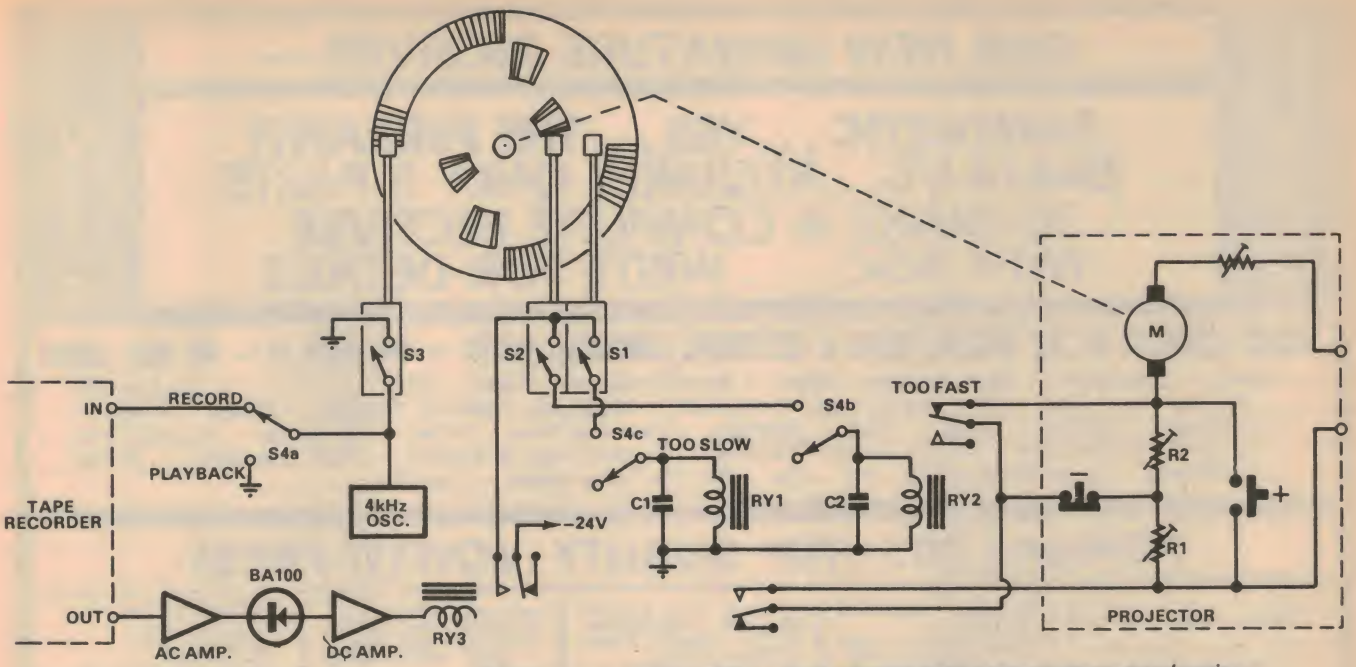


Fig 10 (above): the circuit diagram of a discriminating tape contents synchroniser.

cuits, perform the same circuit functions as the AC amplifier, DC amplifier and microswitches S1 and S2 of Fig 10. As before, the oscillator and power supply circuitry is identical to that used in Fig 8, and the unit may be extended to include the extra facilities offered in the other unit.

To ensure that the discriminating control units as described above function correctly, it is necessary to carefully adjust the values of resistors R1 and R2 until the optimum values are obtained. It may also be necessary to adjust the value of the existing motor series resistor in the projector.

The two tape contents synchronisation units described in Figs 10 and 11, together with the non-discriminating control unit described in Fig 8 of the December issue, can be converted into quasi-integrating control systems by simply connecting counters to record the number of sync pulses from the projector and from the tape recorder. Discrepancies between the two counters during playback indicate inaccuracies in syncronisation, and this may be corrected by pressing the appropriate manual control button until both counters have the same reading.

The basic principles of a true integrating control system were presented in Fig 5 of the November issue. This group of controllers differs from those described above in that the accumulated deviations in tape and film speed are compared rather than

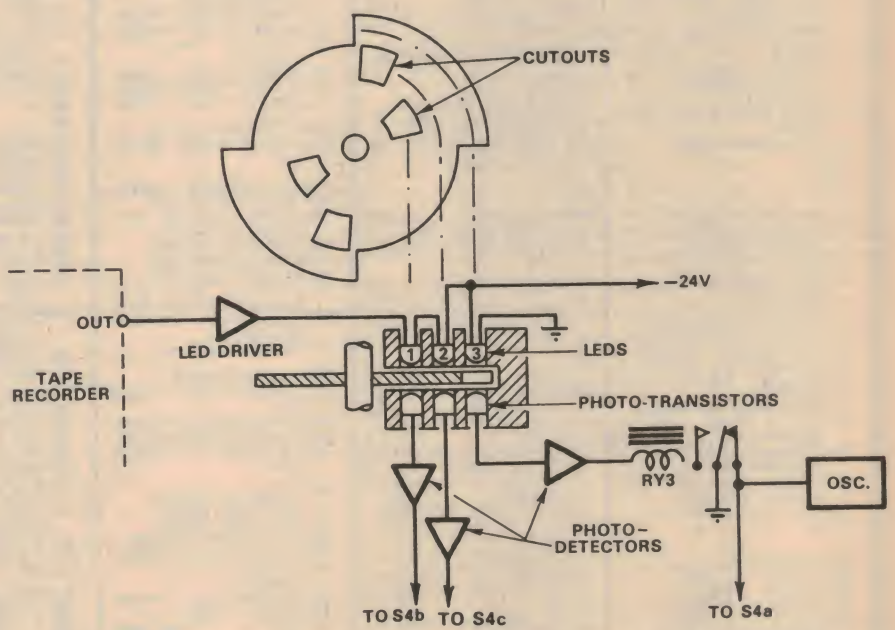
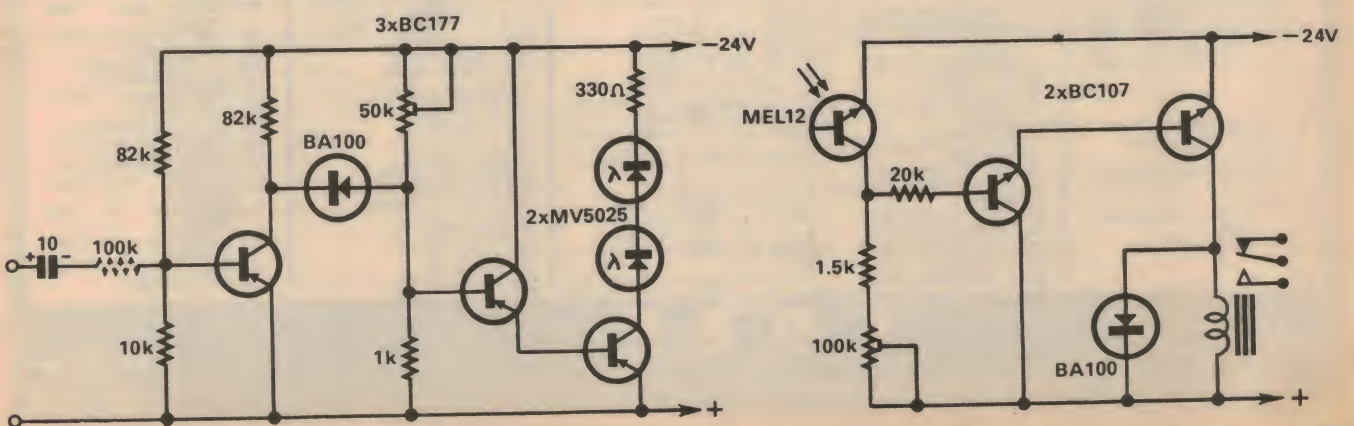


Fig 11 (above): another version of a discriminating tape contents synchroniser. This version uses photoelectric devices in place of the microswitch units. Fig 12 (below) shows the LED driver and photodetector circuits used in Fig 11.



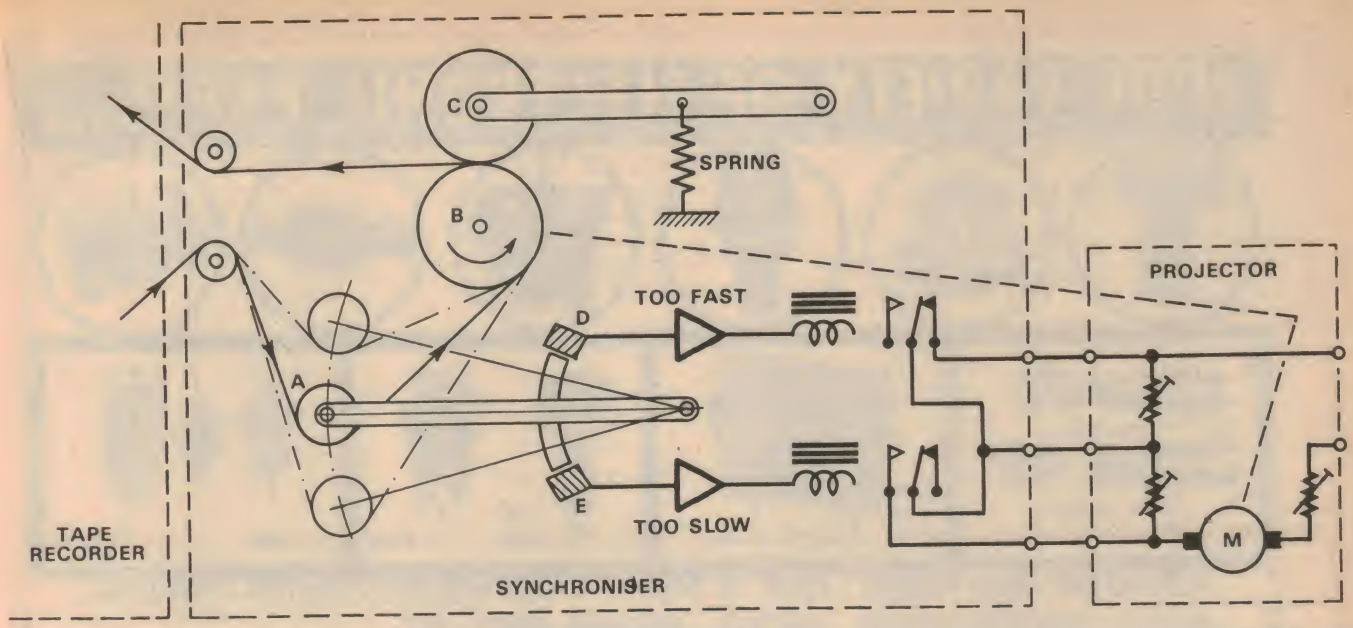


Fig 13: the circuit diagram of an integrating tape-bypass, loop detector synchroniser.

the momentary deviations. Integrated controllers can be made in both non-discriminating and discriminating forms, but discriminating versions only are described below.

The most commonly known integrating control system is the tape-bypass, loop-detector system (Fig 13). The tape is fed to the synchroniser via a moveable roller (A), which is mounted on a spring blade, and a fixed roller (B) operating in conjunction with a pressure roller (C). The fixed roller (B) is driven by the projector.

If the tape speed and the projector speed are synchronised, the tape loop will remain constant, leaving roller A in mid-position. However, if the projector speeds up, the loop shortens and roller A moves towards the fixed roller B, activating the "too fast" relay via an inductive sensing head (D). Similarly, if the projector slows down, the loop will enlarge, resulting in roller A moving away from roller B and activating the "too slow" relay via inductive sensing head E. The two relays switch resistors in and out of the circuit in exactly the same manner as for the discriminating control units described above.

Another mechanical integrating control system may be made up by using a differential gearbox arrangement as shown in Fig 14. This unit consists of four gearwheels, two of which (A, B) are free running around shaft C, which in turn is connected to bridge D. This bridge is free running around shafts E and F, to which gearwheels G and H are coupled. Shafts E and F are driven by the projector and the tape recorder respectively.

If the two shafts E and F are rotated in opposite directions with exactly the same speed, the bridge D will remain stationary. However, if shaft E tends to increase in speed relative to shaft to F, the bridge will begin to rotate in the same direction as shaft E. Similarly, if shaft E slows down with respect to shaft F, the bridge will rotate in the same direction as shaft F. An aluminium vane, which is coupled to bridge D, is used to activate one of the inductive sensing heads whenever movements of bridge D occur. Inductive sensing heads S1 and S2, together with their associated electronics, are used to activate resistors in the projector motor circuit.

In order to eliminate the possibility of the bridge D making a complete revolution (and thus cause loss of synchronisation), it is advisable to incorporate two extra inductive sensing heads (S3, S4) which, when activated, temporarily switch off either the tape recorder or the projector. This situation is most likely to occur during the initial stages of operation. Note that in order to use this type of integrating unit, automatic projector start is a necessity. This feature may be incorporated along the same lines as those used in Fig 8 of the December article.

Construction of the integrating control unit shown in Fig 14 is quite straightforward. The unit is assembled around four small gear wheels, and will perform satisfactorily as long as the facing gearwheel pairs are identical to each other. In order for the system to function as quietly as possible, it is sometimes an advantage to have gearwheels A and B larger than G and H. The tape roller diameter can be calculated according to the formulae presented in the December article. Magnetic reed switches, or photoelectric devices, could be employed as an alternative to the inductive sensing heads.

The above method becomes much more complicated if the tape contents are used as a source of sync information.

All of the controllers described are capable of giving good results under normal circumstances. The reader is advised to start with one of the simpler versions and to extend this until his requirements are satisfied.

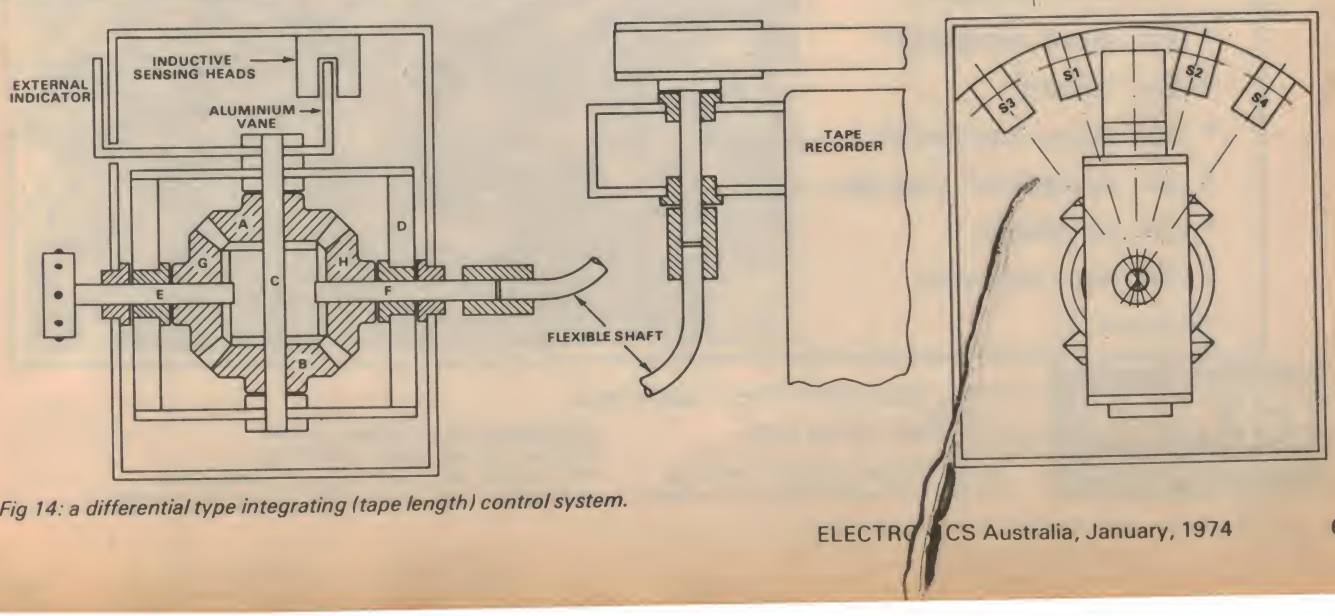


Fig 14: a differential type integrating (tape length) control system.

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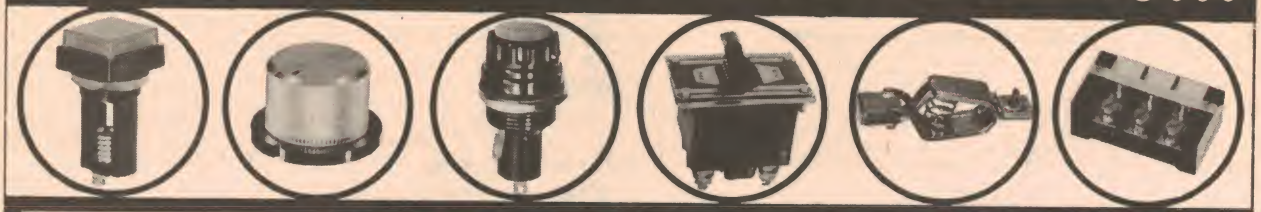

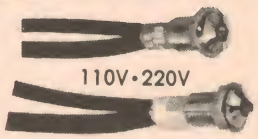

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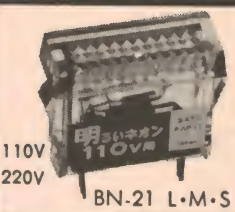

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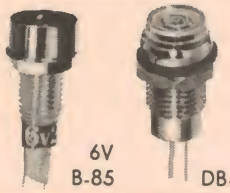

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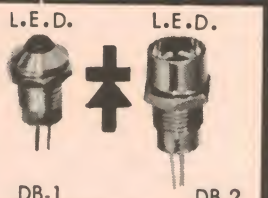

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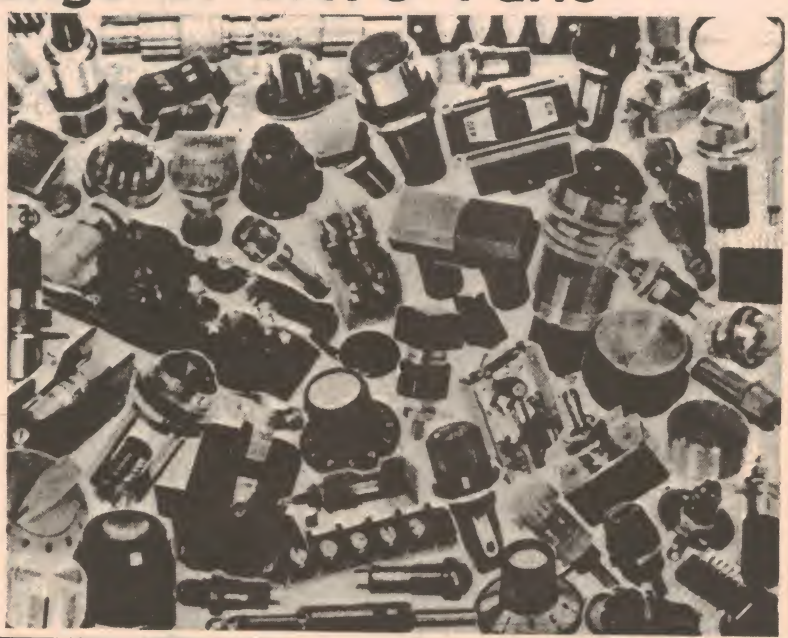

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The Spectra Physics type 060-4 laser tube, rated at 0.5 milliwatts output.

Updating our August 1969 Helium-Neon gas laser

The original laser tube used in our very popular experimental laser design of August 1969 is no longer available. This article gives details of a cold cathode tube of more recent design which is suitable for the project, and describes the minor circuit changes which it requires.

by JAMIESON ROWE

Although the laser tube used in the original design was far from cheap — it cost around $150 plus tax — the project was a remarkably popular one. A considerable number have been built up by schools, technical colleges, universities and by a small number of enthusiastic hobbyists.

Laser Electronics Pty Ltd, the suppliers of the tube, tell us that they still receive regular orders and enquiries — more than three years after the project was described. Fairly obviously there is still a good deal of interest in do-it-yourself lasers!

As it happens, however, the original tube used in our project is now regarded as obsolete, and is no longer available from the US manufacturers. Recently Laser Electronics thought they had lined up a very similar tube, the CW-50, and sent us brief details of this tube which we published in the December issue (p.111). But no sooner had we done this that the news came through that this tube had also become unavailable.

All's well that ends well, however, and Laser Electronics have been able to obtain yet another type of tube. This is the type 060-4 from the Californian firm Spectra Physics, for whom Laser Electronics are the sole Australian agents.

The 060-4 tube is very similar in its performance to the original tube, yet costs only a little more than half the original price: $85 plus 15pc sales tax if applicable. Like the original tube it has a nominal light output of 0.5mW.

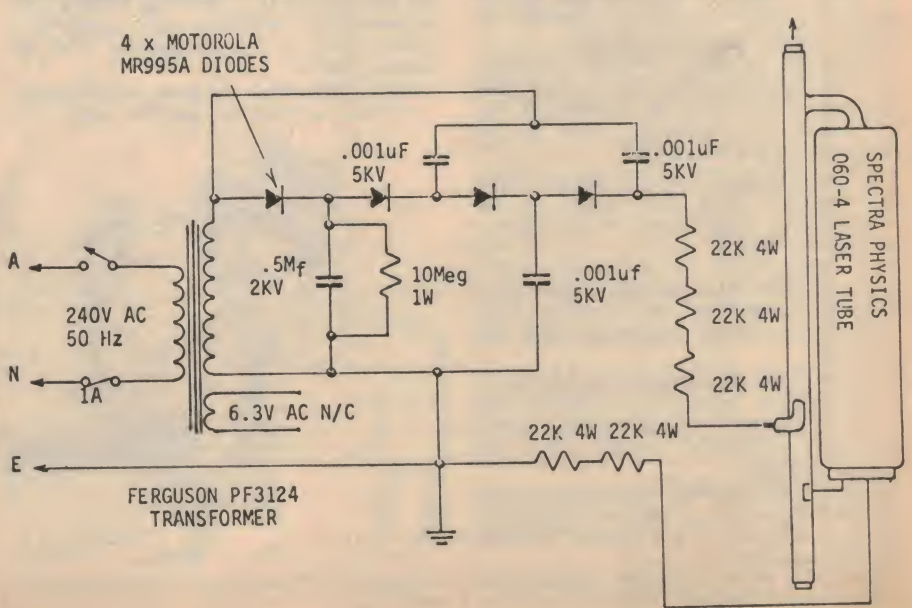
The main difference between the two is that the new tube is of the cold cathode type, and does not need heater excitation. Apart from this the only circuit change required is an additional 22k / 4W resistor in the ballast chain. Laser Electronics recommend that the chain be split in two, as shown, with two of the resistors in the cathode return. This is to reduce lead capacitance and assist in starting, particularly when the tube gets very old.

We used GE controlled-avalanche A14P 1000V diodes in the original circuit, with three in series per multiplier leg. These diodes are still available, and would still be quite suitable. However Laser Electronics have suggested using four of the Motorola MR995A diodes, which are now also available. These are rated at 4kV PIV and 250mA average current.

The only other point of interest is that the 060-4 tube is physically rather different from the original tube, consisting of a narrow-bore laser resonator with a larger cathode tube alongside. This will call for a rather different method of tube mounting, and also for a slightly longer case. Overall tube length is 28.3 cm.

For futher information regarding the Spectra Physics 060-4 tube, readers may write to Laser Electronics Pty Ltd at P.O. Box 359, Southport, Qld 4215.

Above is the original laser unit, as described in the August 1969 issue. At right is the circuit as modified to suit the Spectra Physics type 060-4 tube. As the new tube has a cold cathode, the heater winding is now not used.



FORUM

Conducted by Neville Williams

We agree! We'd like to oblige, but . . .

From time to time we receive requests and suggestions from readers about the contents and format of the magazine. Some we can adopt, but others with seeming merit are found impractical, sometimes for quite subtle reasons. Responding to them often presents a dilemma, if our motives are not to be misunderstood.

By way of example, we quote a letter recently to hand from a reader who has signed his name but given no address.

Dear Sir,

I would like to make one or two observations regarding the format of your magazine.

1: As one who has built a number of your projects, I suggest that the articles should be split up into such headings as the following: Description of device; principle of operation; constructional details; adjustment procedures; specifications.

This would help enormously. Many times I have had to skip-read the whole article just to find a minor detail. Prominent subheadings and divisions would alleviate this problem.

2: At various times, other correspondents have requested that the format should be such as to make the filing of articles easy; e.g. only printing a project on one side of a sheet. Having tried to file articles from your magazine to make quick reference possible, I endorse these requests wholeheartedly.

Yours faithfully, B.B.

As a reader, the correspondent is obviously quite sincere, believing that we should be able to meet his requests by simply doing this instead of that!

From the editorial viewpoint, however, we know that there is far more to it and that the suggestions may be difficult, if not impossible, to implement. How do we respond in such situations?

- We could reply privately to the particular correspondent, but this might be interpreted as unwillingness to publicise a reasonable request.
- We could publish the request(s) with a brief explanation as to why it (or they) could not be satisfied; unfortunately, brief explanations all too frequently look like excuses!
- We could give detailed reasons why not — to the possible annoyance of readers who are not interested in the proposition, and to whom the discussion would seem like wasted verbage.

Because others may be thinking along similar lines to B.B., I have decided on this occasion to follow the third course and risk possible criticism.

To take in order the points raised in the letter, we do normally structure our staff articles along the general lines: Introduction and explanation; operation; construction; adjustment; specifications in a separate panel.

These are only broad guidelines, however, and we try to let the writer's reactions come through spontaneously, rather than force the article into a too stereotyped format. Looking back over many years, readers seem to have appreciated this approach, because it makes the magazine more readable as prose. Far more people, in fact, read the articles for background, than actually build the projects.

Again, many project articles cannot be sub-divided as easily as the proposition assumes. There may be close links between the design approach, constructional aspects and the ultimate adjustment procedures, and it may be more logical to discuss them together, or in something other than a stereotyped progression.

Really, it boils down to this:

People who want to read about projects and share the reactions and findings of the writer are best served by spontaneous prose.

People who want to construct a project are best served by something written like an instruction manual for a kit — helpful if you're using it but impossibly dull as reading matter!

Fairly obviously, we must compromise.

We are, of course, familiar with yet another style used by some overseas magazines: what it is, how it works and how to build it — all in nutshell form. Some who merely want ideas like this presentation, but others find that a great deal is left unsaid.

I'm glad Jim Rowe is a level headed person, otherwise .....

However, B.B. has raised the point and we will talk about it in our next staff conference.

His second suggestion about the physical format is quite a different matter, which can evoke only a sad shake of the head.

Let me say, right at the outset, that the desire to file technical articles is understandable and, in fact, is a compliment to our technical staff. To find pages of an article back to back is a nuisance if you want to paste them in a book. The point is conceded.

I must also concede that it is sometimes possible to pick up a finished magazine and indicate how certain things could have been made more convenient and more logical by simply swapping this with that — obviating at least some back-to-back placement, achieving a better flow of subject matter, more effective use of colour, less conflict between advertisements and so on.

Perhaps it is being wise after the event but couldn't some of these things be achieved in the first place? Is there a lack of thoughtfulness, or care?

In an idyllic situation, many such things would be carefully pre-planned and executed to please the greatest number of readers.

But I think it is relevant to state a few essential components of an "idyllic" situation and contrast them with reality — a reality which is shared to a greater or lesser extent by all comparable magazines.

1: All technical articles, pictures, and drawings would be completed in plenty of time; accurately sized and ready to lay into appropriate spaces. In reality, if we are to react quickly, with the available staff, to new techniques and component situations, we cannot have all technical articles in that cut-and-dried situation.

2: No unexpected crises with component details or supply, or with the content of technical articles. In real life, we are constantly having to adapt to component changes and hold-ups, involving last-minute modifications to projects, pictures, drawings, &c. As for contributed articles, we could write a book about the problems which arise between the original text and what finally appears in print.

3: All advertisements booked and immutable before the magazine is laid out. What a blissful situation! Advertisers would also count it bliss if they knew that far in advance what they would have on their shelves at the time of publication! In real life, with manufacturing and importing hold-ups, they try to leave their booking as late as possible. And, even then, there is no guarantee that an unexpected cable will not cause them either to want to cancel or to book extra space!

4: Staff and facilities to assemble and print the magazine in the shortest possible time. In practice, it is a costly business to employ staff on a "peak load" basis and, as a monthly magazine, we have to lay out a significant proportion of the magazine BEFORE all the factors are known, not after. This is the converse of planning; it is real "crystal ball" stuff!

5: The magazine would be printed at the one time, allowing last minute changes to be made. In practice, magazines commonly

have to be printed in sections, according to the capacity of the presses; some sections may be finalised and printed days ahead of others, to meet press schedules. Adjustments and emergencies can only be covered in the pages which are still flexible.

All this adds up to the fact that very rarely is a magazine ever laid out in a single operation, free from prior commitments and with all the parameters known. It tends to grow like the proverbial "Topsy" right until the last page goes to press.

In real life, the Editor or his deputy starts out with a planning grid showing the magazine size and colour-fall dictated by economics, by advertising requirements and the mechanics of the printing press. Into this, he has to merge articles which have already been laid out with those advertising spaces which are hopefully "firm."

The space left over has to be filled progressively and as logically as possible with other advertisements as they come to light, and other editorial material as it comes good.

And, while so doing, he has to cope with the kind of emergencies referred to earlier. Overall, it is a complex exercise which is sufficient to send an editor home at nights with a flourishing ulcer!

I'm indeed glad Jim Rowe is a level headed person, otherwise we'd have heard a loud bang from the Editor's office long before this!

What does all it add up to?

Simply this: These days, in a practical situation, a publisher is "flat out" to meet major and conflicting requirements fundamental to the viability of a magazine. It is just not easy to squeeze in yet more conditions which have to be satisfied.

That is, not without going completely round the bend!

While this is made as a general statement, it certainly applies to the idea of not having editorial pages back to back. As a further parameter it would be intolerable. In terms of space allocations it might even be impossible!

In saying this, we are simply aligning ourselves with the majority group. We are not aware of any comparable magazine which confines its editorial articles to one side of the paper. It's just possible that they have to cope with comparable pressures!

FRUSTRATED LISTENER

To change the subject, the letter on this page is from a Victorian reader who is obviously disgruntled about his inability to tune many interstate and country broadcast stations. He apparently believes that all such stations should be free from interference when heard at a distance on a high performance receiver. The fact that they are not is interpreted as incompetence or collusion or lawlessness on the part of all those concerned, from the PMG authorities to the radio industry itself.

In fact, "Fed Up" is under a complete misapprehension. Let me explain why.

Assuming that the medium-wave broadcast band is allocated to stations on the basis of 10kHz separation, there can be clear channels for fewer than 90 stations. Furthermore, if there is to be no interference, this number of stations would have to serve the whole of Australia, New Zealand and adjacent territories.

Unfortunately, 90 broadcast band stations is not nearly enough to ensure a sufficiently reliable and "local" service to the inhabitants of this large area and the authorities were faced with a "devil's choice." They could ignore the need, or try to bridge the gaps with sheer transmitter power, or authorise more transmitters.

They chose the last-named course, in the knowledge that extra transmitters would have to share channels with existing stations. They were careful, however, to site them well apart and, in some cases, to specify directional aerial arrays. Because of these provisions, each transmitter could be counted on to serve its own area without interference from other transmitter(s) on the same frequency.

As a result of this policy, broadcast band channels in the Aust-NZ region each carry an average of three stations, all serving geographically separated areas.

People living in those primary service areas are normally unaware of the duplication. It is quite a different matter for people remote from all three who like listening to DX. They hear the signals simultaneously, and in erratic fashion as they fade up and down.

In fact, they may well hear signals in adjacent channels and the resulting 10kHz whistles.

Reacting to the situation, "Fed Up" believes that he has been robbed of his rights; that his broadcast listener's licence implies that all stations in the country should be available to anyone who invests in a high performance receiver.

It isn't that way at all. The licence confers the right to use a broadcast receiver; the authorities reciprocate by trying to ensure that a reasonable choice of programs will be available to as many listeners as possible. Officially, the Melbourne transmitters are deemed to provide that reasonable choice to residents of that city.

They would include our correspondent.

There is nothing whatever to stop "Fed Up" from purchasing a high performance receiver and trying to log as many stations as possible. But the medium wave broadcast system isn't designed to serve DX hobbyists; it's intended to serve localised listener groups.

Is it worth investing in a high performance receiver? That's up to you, "Fed Up"!

"POST OFFICE COPS"

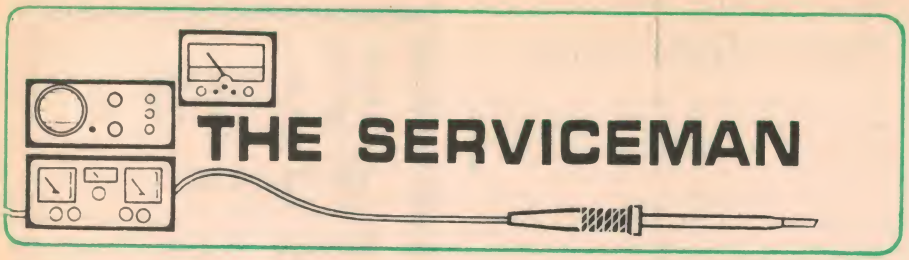
Your article, "Post Office Cops," page 38, October 1973 issue of Electronics Australia, is to my mind a bit of a joke. You should be here in Melbourne.

The last six months has been a period of almost continuous interference from one end of the Victorian Broadcast band to the other, except for Melbourne listeners.

Just about every country station is affected, some interstate ones being completely jammed off the air in daylight hours. The PMG must know what this is all about. People in the electronics game don't seem to know, or if they do they are not telling.

What's the use of building or buying a high performance receiver if long distance transmissions are to be ruined by what appear to be very powerful transmitters. Is there one law for the public and another for the PMG?

Fed up licence holder. (Victoria).



Spoil the ship for a ha'p'orth o' tar

Most individual brands or models of radio and TV sets have their own peculiar faults involving one or two particular components. While most manufacturers are as much a victim of these weaknesses as is the customer, some of them do tempt fate in an effort to cut costs.

One of the frequent faults in EHT systems using a thermionic rectifier is breakdown of the filament loop supplying the rectifier. This loop is normally made from EHT cable, similar to that used for the final anode connection to the picture tube, and (usually) consists of a single turn looped loosely around the ferrite core.

EHT rectifier valves, of which the 1S2 is typical, require 1.4V at about 500mA. Since a single turn normally delivers somewhat more voltage than this, and anything less than a single turn is difficult to provide, a series resistor of about 1.5 ohms is fitted.

Insulation breakdown of the filament loop manifests itself in two ways: there may be complete picture failure, or the customer may complain of loud cracking noises from inside the set, accompanied by interference streaks across the picture.

Closer inspection will reveal several symptoms, mostly visual, but all may not be immediately obvious by reason of the physical layout. In some circumstances the rectifier will get red hot, although this is relatively rare and I have never actually worked out why this happens. More commonly, at least in the case of complete failure, the rectifier filament does not light and there is no EHT. In the case of an intermittent, one can usually see the sparks, or the light from them, every time the insulation breaks down.

Although these comments were not prompted by a particular case, they were prompted by a particular make and model of set. This is a relatively recent model, on the market for only a few years. And, surprisingly for its age, an unusually large number of sets began exhibiting the symptoms I have already described.

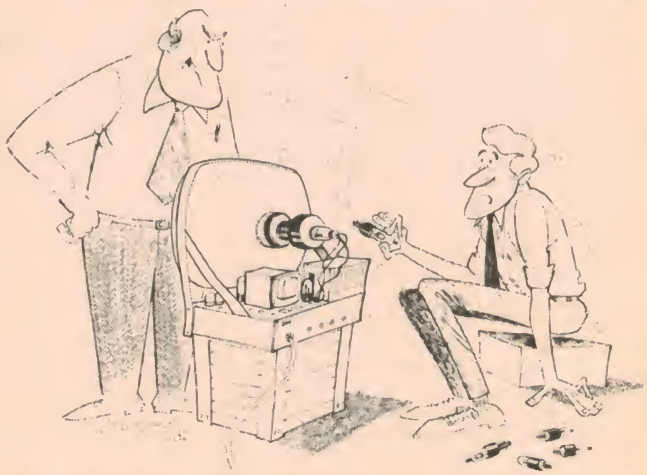
It was then that I took a closer look at the situation and realised the probable cause: for some reason, probably cost, the manufacturer had used a thinner than normal EHT cable for the filament loop. EHT cable is made in a number of voltage grades, one local manufacturer quoting at least four: 5kV, 10kV, 15kV and 20kV. Most manufacturers use what appears to be a 15k V grade, but this was more like the 10kV grade.

I have no doubt that the manufacturers would be fairly conservative in their rating, and that the 10kV grade, when new, might well cope with a 15kV situation. But such a set-up has little reserve against deterioration so that, after a few years in the field, they began breaking down in large numbers.

Which didn't earn the manufacturer any marks as far as the owners were concerned, I can assure you. On the positive side, I was able to assure them that I had replaced the cable with a higher voltage grade which should give them many years of service; that the set was, in fact, now better in this respect than when it was new.

The silly part about a situation like this is that the cost of the cable is only a trifle compared with the labour costs involved in the replacement. Such pinchpenny tactics virtually guarantee that the customer will be involved in an expensive and unnecessary service call after only a few years' service.

And this job can be expensive. Few EHT cages are very conveniently located, and a lot of dismantling has to be done before one even comes to grips with the faulty part. After that, a new loop has to be fitted, generally quite a fiddling job in itself, then everything else restored.



"How many more 1S2s, before you find the real fault?"

Strictly speaking, it is not a job to be done in the customer's home. Yet the alternative — removing the entire chassis, transporting it to the workshop, then returning and refitting it — is certainly no more attractive, with the added disadvantage of greater inconvenience to the customer. So, the usual result is that one tackles it on the spot, in spite of the problems.

Deterioration of such cable appears to be a fact of life we must accept at the present state of the art, even though plastic is many times better in most situations than the rubber insulation of the "good old days." Just what causes the deterioration I am not quite sure, but it does appear that heat is a major factor. The insulation is polythene, encased in an outer PVC sleeve, and heat can cause first a softening of the PVC followed by a hardening and then a cracking. In almost all the cases I have encountered there has been some cracking of the outer sleeve.

It has been suggested that other factors, particularly the likely presence of ozone in this environment, may also contribute to plastic deterioration. While such a suggestion is somewhat speculative, I was fortunate enough to be able to put the question to an organic chemist who, incidentally, also has a fair background of practical radio and TV. His comment was as follows.

"Voltages in excess of 10kV, with the appropriate atmosphere, will convert between 1pc and 3pc of the air to ozone. This gas is highly corrosive of almost all substances other than the platinoid group of metals or the plastic, Teflon.

"The generation must be a silent discharge, any corona or spark discharge will destroy the ozone. (In the event of spark or corona, various oxides of nitrogen will be generated which, with the exception of nitrous oxide, N20, are also corrosive in a humid atmosphere.) The oxygen molecule will convert to ozone more readily with an increase in temperature and it must be noted that high ambient temperatures are normal in TV sets, particularly valve sets."

So there it is, for what it is worth. It is by no means a conclusive statement; there is nothing to indicate how much effect the ozone, if generated, will have on the insulation. But it is worth thinking about, and others may be in a better position to comment.

But to get back to the practical side. When these loops do have to be replaced there are a few points worth keeping in mind. The 1.5 ohm resistor, mentioned earlier, may sometimes have to be removed in the process, in which case it is often more convenient to substitute an alternative type of cable, having a resistance wire conductor in place of the normal copper. This runs about 1.75 ohms / ft, or about 10in for 1.5 ohms. This is usually a convenient length.

And while on the subject, don't be trapped by a circuit which does not have a resistor. It is virtually certain to use resistance wire, so don't replace it with copper wire. If you do you will be wondering why that particular set is hard on rectifiers.

Which reminds me of how a colleague was caught. His assistant replaced a faulty 1S2 rectifier in a set — just that and nothing more — but the rectifier failed after only a few months. The assistant replaced it again — and again, a few months after that. After

about the sixth rectifier (yes, that's right) my colleague happened to come across the customer's service card and nearly had a fit when he realised what had been going on.

A hasty examination of the set and the service manual confirmed his suspicions: it was one of the few models which used a type 6S2 in place of the more conventional 1S2, with a modified pickup loop to supply the 6V needed for the filament. While the regulation of such a system would probably be poor and unable to maintain this voltage at the heavier load, it would still have been a lot higher than 1.4V. Poor 1S2!

Getting down to more specific case histories, here is a story about an eight transistor radio with a rather unusual fault. The owner had stated simply that it was "dead" — and maybe it was to him — but the symptoms were rather more subtle than that.

I plugged it into the bench power supply and switched on. It gave out a weak and very distorted signal. I could understand why the owner may have regarded it as "dead", it was quite useless as far as he was concerned. On the other hand, the difference between a set which is really dead, and one with symptoms like this can be quite important as far as the serviceman is concerned.

Having noted the weak and distorted signal, I was immediately struck by the behaviour of the current meter in the power supply. It was jumping around like a cat on a hot tin roof. More precisely, it was behaving exactly as I would expect a typical class B stage to behave when it was functioning normally.

In other words, although the output stage appeared to be functioning normally, the signals were not coming out of the speaker. A number of possibilities suggested themselves. There could be a high resistance fault in the voice coil circuit, which included the voice coil itself, the transformer secondary winding, or the earphone jack between the two.

I checked all three, and found them to have suitably low values of resistance. Which seemed to throw suspicion back onto the primary side of the transformer, in spite of the fact that, according to the supply meter, the output stage appeared to be working correctly.

Using an audio probe I checked the signal level at both output transistor collectors. When I found that the level at one collector was a good deal louder than the level at the other collector, I knew I was on the right track. A resistance measurement across the two halves of the primary showed that one was presenting a virtual short circuit to its associated output transistor.

This was unusual. Transformers can go open circuit easily enough, but they seldom go short circuit. I removed the transformer and checked it out more thoroughly. In fact, it turned out to have a short between primary and secondary and when I studied the circuit against this information I could see how this showed up the way it did.

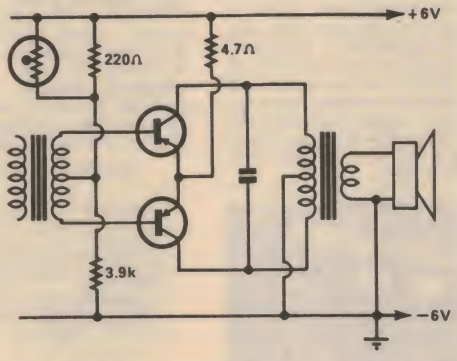
The circuit is somewhat unconventional, in that it is inverted. It uses PNP transistors but the active rail is positive. Since the collectors are fed from the negative rail they are, in fact, connected to chassis. Thus, the transformer centre tap is connected to chassis, as is one side of the transformer secondary and its associated voice coil.

As a result, the short between some part of the primary winding and the secondary winding was really a short across part, or all, of on[illegible] winding.

Which is enough to upset any class B stage. Not only was one output transistor partly or wholly out of action, leaving the other one to supply its half of the waveform, but the short circuited section of the transformer would also load this latter transistor. Not much wonder the output was weak and distorted.

Not much wonder that I had been trapped either. It is not the first output transformer I have found with a primary-secondary short but, in a more conventional circuit, a short from anywhere on the primary winding to chassis will produce a heavy current drain which provides an immediate clue to the fault. But with the primary at chassis potential the DC conditions were not disturbed.

I need hardly add that a new transformer cured the fault.



The fault was a simple one but, because of the inverted circuit configuration, it did not disturb the DC operating conditions. This would have been a very obvious clue in a more conventional circuit.

Finally, a brief comment from a reader in Mildura, Victoria, concerning my story in the July 1973 issue about a speaker magnet which was completely demagnetised. He comments:

Your article about the speaker was interesting. My explanation is as follows. Contact with the mains must have been a brief glancing blow. Actual metallic contact was of too short a duration to damage the voice coil, but the resulting arc tapered off the current in a manner suitable for demagnetisation, as the gap widened.

You could have re-magnetised the speaker in a similar manner by connecting it to the mains with a fuse in series. On AC a fuse always blows on or near peak current and the heavy peak current would provide the magnetising force.

Yours,

H.H.

Thank you H.H., for an interesting comment. Your theory about the demagnetising sequence is particularly interesting since, as I recall the incident, the contact was a glancing blow, as you suggest.

Your suggestion concerning re-magnetising I find somewhat less convincing. I have no doubt that the theory is sound, but I would hate the job of nominating a fuse which would pass sufficient current to remagnetise, without passing so much that the voice coil would be damaged. Plus the fact, of course, that I had no idea what the situation was until I had pulled the speaker to pieces, after which it was too late.

Still, it is an interesting theory.

Dick Smith Ele

Dick answers your questions

We get a lot of people writing in and asking us why we don't open stores in other parts of Australia. What's the reason Dick? Frankly I don't think it is necessary to have stores sprinkled around the country if . . . and I hasten to add there are some important ifs. The first is 'if you have a good catalogue.' The catalogue has to give very detailed descriptions so that the reader can be reasonably sure he's going to get what he wants. That's why we give as full a specification as we can in ours (in fact a lot of people use it as their 'Bible' because of all the information it contains).

The second if is 'If you have an efficient Mail Order department'. I spent a lot of time on my overseas trip looking at Mail Order in the USA where it is used a tremendous amount. Our Mail Order department has been designed from their experience. Users have a choice of 'fast' or 'slow' delivery — Comet overnight or Post. So that if a part is wanted really urgently a customer can phone us, telegraph the money, we can hand the goods to Comet and it will arrive the next day. I know that is a bit slower than going down to your local store but that brings us to the third if — 'If it's in stock'.

Everyone knows that the component situation is getting worse and worse. So where's the point in having stock distributed all over the place? Surely it's better to keep it all in one central point so that everyone can draw on it? Having stock spread between several stores means that an item can well be out of stock at store A and collecting dust at Store B. Also there must be an inevitable overstocking if all stores are to provide the sort of service customers would expect. Holding extra large stocks costs money and I don't have to tell you who pays for that!!

So, as I see it, the only advantage of having a local store is that you can see the goods if they happen to be in stock which brings me to the last if: 'If you have a proper money back guarantee.'

Everything we stock is brand new and we give a money back guarantee in addition to any manufacturers guarantees. As we say in the catalogue, 'If you aren't satisfied with the goods, for any reason, return them within 14 days and we will exchange the goods or return your money.'

If I can just recap, we don't have stores all over the place because we operate an efficient Mail Order system, have a detailed catalogue, goods can be in the customers hands rapidly with a money back guarantee. And finally our catalogue has a dead easy mail order form — why don't you try it out?

Magnetic Stereo Pre-Amp Module

Complete ready-wired on a PCB measuring only 1¼" x 2½". Two high gain transistors per channel. Frequency response from 30Hz to 20kHz within 1db of RIAA curve. 2mV sensitivity for 150mV output with input impedance of 50kohm. Typical noise figure is -68db with distortion below 0.04% $11.25 (P&P 30c).

Trio 9R-59DS Communications Receiver

An ideal set for Amateurs and Short Wave Listeners. 4 bands covered from 540kHz to 30MHz. Two mechanical filters to improve selectivity. Product detector for SSB. Large dials for accurate tuning. Automatic noise limiter. Calibrated Bandspread. 'S' meter and BFO.2uV sensitivity for 10db S:N. Built-in speaker and 1.5W output. $180 (P&P $3.00)

SPECIAL THIS MONTH

Get off to a good start with a FREE copy of World Radio and TV Guide (available separately also). This is a complete directory of every radio and TV transmitting station in the world. Over 400 pages of cramped print to give the listener all the facts and figures. Constant reference book for Amateurs and SWLs. Recommended by Radio Australia. We have fresh stock just in at $5.75 or FREE with the Trio 9R–59DS.

Educational kits

Crystal Radio Kit

An all time favourite, brings in the local stations without a battery. Build your first radio in under 1 hour $4.95 (P&P 30c).

10 in 1

Includes a solar battery and enables several radios, signal generator and morse code oscillator to be built. 10 projects in all for $8.95 (P&P 50c).

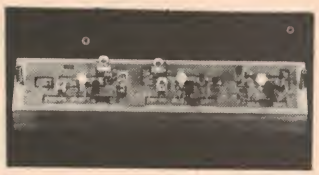
50 in 1 Solar Energy

Kit gives 50 experiments using relay, meter, transistor, transformer etc. Uses two batteries. With 58 page manual $21.95 (P&P $1.00).

150 in 1 The Ultimate

(See ET Nov 73) a magnificent kit in wooden case with enlarged visualised IC, radio tuner, CdS cell, transformer etc. No soldering to build 150 different circuits over and over again and some of your own. $35.95 (P&P $2.00).

Kits



30 Watt RF Kit

Only available from us and specially produced for our many Amateur customers. Available in 3 stages which together give 30 Watt out from 300mV in at 144MHz from a 12.6V. supply. Uses the Solid State Scientific transistors. 7W stage complete $11.50. 15W stage complete $13.50. 30W stage complete $17.50. Individual boards $1.50 or the complete kit (saving $5.00) for only $37.50 (P&P 50c).

(See review on page 56.)

High Power Strobe

We've redesigned the layout of the popular ETI 505 strobe (circuit in 25 Top Projects or see our catalogue). Assembly is simpler and quicker. Our kit also includes a very handsome spun aluminium reflector, Plessey capacitors — in fact everything ready to plug into 240V supply at only $26.50 (P&P $1.00).

Digital Clock

(E.A. Sept 73) We have only a few of these left at the special offer price so hurry. Based on the Sperry gas readout and National IC, this kit provides full 24 hour mains operation. Display is easily read from 40ft away. The National IC provides 4 or 6 digit operation. All parts, excluding case, cost only $49.00 or Readout, IC and transistors for only $28.75 (Both P&P 50c, but hurry!).

Digital Counter

(E.A. Dec 73) We have the complete kit with a professional type case to make this useful instrument look like one costing much more. Kit also includes crystal, readout etc — in fact everything you need to make a really good job. 20MHz counter only $116 (P&P $2.00) or complete with prescaler to extend range to 200MHz $135 (P&P $2.00).

New 910-60 Digibezel

Imported from the USA for you digital enthusiasts. Handsome front escutcheon has 2" x ¾" window which fits chassis up to ⅛th thick with simple clip. Beaut matt black finish for a really professional look to your clock, counter etc. Also included is a red polarising filter to improve legibility in high ambient lighting conditions $4.75 (P & P 50c).

Playmaster 136

The ever popular kit. Compares favourably with commercial units costing very much more. Has expensive looking brushed panel. We also include Silicon Grease to improve thermal conditions in output stage. This one is a Superkit complete with article reprints etc for $65 or less Fairchild special offer transistors $55.60 (Both P&P $1.00).

Calculators

1200 Ruby

6 digit display with 12 digit capacity. Selectable decimal point, does all the usual calculations including chain multiplying etc. Bright easy to read magnified LED readout. Use 9V transistor battery. Worth at least $10 more at only $59 (P&P 75c).

8012 Grantham

is a desk top model with floating decimal point. Operates from mains. Constant key, overflow indication, leading zero suppression etc and 8 digit display. Ridiculous price of only $79.00.

1211 Grantham

is the cheapest anywhere with a full memory. 12 digit display, constant key, percentage, clear entry etc. Truncate switch and 8 place selectable decimal point. All this for only $115 (there must be a mistake?)

All these calculators have our money back guarantee plus AUSTRALIAN suppliers 3 month workmanship guarantee. You can't go wrong.

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Limited shipment of Transceivers

(Licence Required)

5 Watt Mobile Transceiver 13-869 (Amateur Use Only)
For mobile, or base station use. 16 transistor and 6 diodes. Meter indicates incoming signal strength and relative output power. 23 synthesised channels, squelch, noise limiter, P.A. facility. Suits + or -ve ground vehicles $109 (P&P $1.00).

NC310 1 Watt transceiver

Here's the deluxe of all 27MHz transceivers. 13 transistors, 3 crystal controlled channels, tone call switch, squelch, battery check meter etc etc. Ultra-sensitive 0.7uV receiver with ceramic filter. Handsome diecast case with sockets for external antenna, speaker, power etc. One set of crystals included plus full circuit details in manual $48.00 (P&P $1.00).

Midland 13-700 Transceiver

A very popular unit with 12 transistors and operating on two channels (one set of crystals included). Full 1 Watt power output. Superhet receiver with tuned rf stage. Calling tone .13 section 60" antenna. Only a few of these at $39.95 (P&P $1.00).

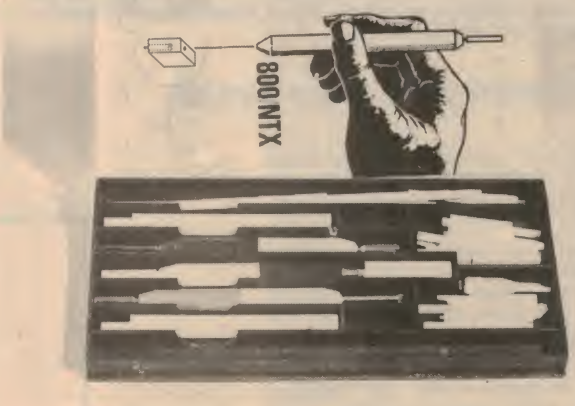
Service Aids

Philips Signal Injector

Don't confuse with the usual injectors. This one is a real professional model for locating faults in amps, radios, and TV with particular emphasis on colour. Accurately tuned oscillator with square wave modulation. 5 transistor circuit. Two frequencies for use on all colour TV systems. Simple internal adjustment. Anyone contemplating an involvement with colour should have one (Yes! It's especially designed for the PAL system. $19.55.

Philips Alignment Tool Kit

If you usually fiddle around with sharpened matchsticks when you align your IFs then this kit is for you. There are 27 bits and pieces to suit any core slot or what-not. Extensions, grips, handles, slots, screwdriver bits etc, etc. As an alignment aid it's unbeatable, ensuring there is no inductive or capacitive effect on your adjustment. All radio enthusiasts, servicemen etc should have one $6.90 (P&P 50c).



Soldapullt

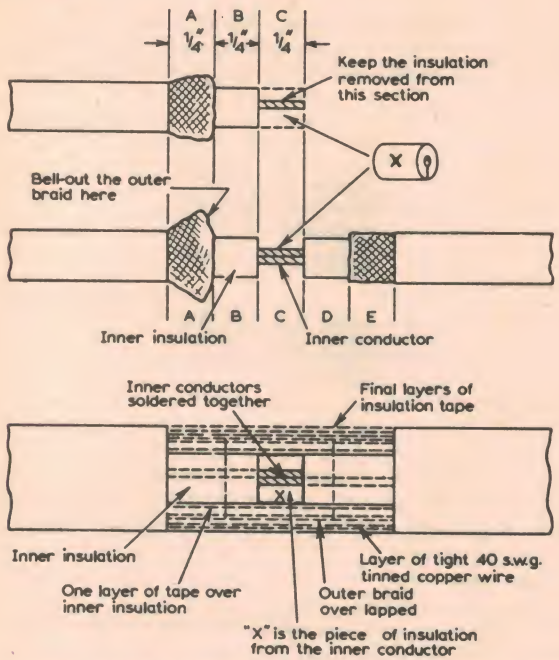
Big brother to the very popular Soldavac ($6.95). Made in USA too with an even greater thirst for solder thanks to the powerful spring action, hydraulically-braked mechanism. Invaluable for removing ICs etc. Self-cleaning tip in Teflon spout which is replaceable. Intended for a hard life. $9.95 (P&P 50c).

Send 30 cents to cover P & P for your FREE catalogue — 64 pages — Full of useful data — 50 cent discount vouchers Mail Order form etc — Mention this magazine.

CIRCUIT & DESIGN IDEAS

Interesting circuit ideas and design notes selected by the Editor from technical literature, reader contributions and staff jottings. As they have not necessarily been tested in our laboratory, responsibility cannot be accepted. Contributions to this section are always welcome.

Joining coaxial cable



The usual way of extending coaxial cable is to use a coaxial connector. After exposure to the elements it is not uncommon to find that the connection has become oxidised, despite the fact that it was "protected" by insulation tape.

The alternative method to be described should appeal to those who wish to join up lengths of coaxial cable and forget about them.

Proceed as follows, referring to the sketches for any clarifications necessary:

1. Cut the ends of the coaxial cable to be joined to give clean ends. Carefully cut of ¾in of the vinyl covering at the end of each cable, taking care not to cut the outer braid.
2. Loosen and push back the braid like a concertina. Bell-out the outer braid of one cable.
3. Carefully cut off ¼in of the inner insulation, again taking care not to cut any strands of the inner conductor, so that that the insulation slides off the wire. Keep one of these pieces of material as it will be required later.
4. Lay both cables down on the bench and clamp down in position so that the two inner conductors lie close together and parallel and solder them together.
5. Take the piece of inner insulation and slit it lengthwise halfway through with a razor blade. Slip the insulation over the soldered joint.
6. Cut a piece of aluminium cooking foil ¾in wide and long enough to make a double thickness cylinder to cover the areas marked B, C and D. Heat this cylinder to about 100 degrees C with a soldering iron when the insulation will be pliable enough to weld together. Discard the foil and allow the insulation to cool.
7. Tightly wrap a single layer of ¾in adhesive vinyl insulation tape over the section BCD. Smooth section A over section E. Roll and smooth the overlap to make it even, and spot solder the edges.
8. Starting at one end of the outer conductor braid close wind the whole areas of ABCDE with 36B&S tinned copper wire. Lightly solder several spots of this covering. Do not try to make a solid soldered job, as this will ruin the inner insulation.

(By R. A. Butterworth, in "Practical Wireless.")

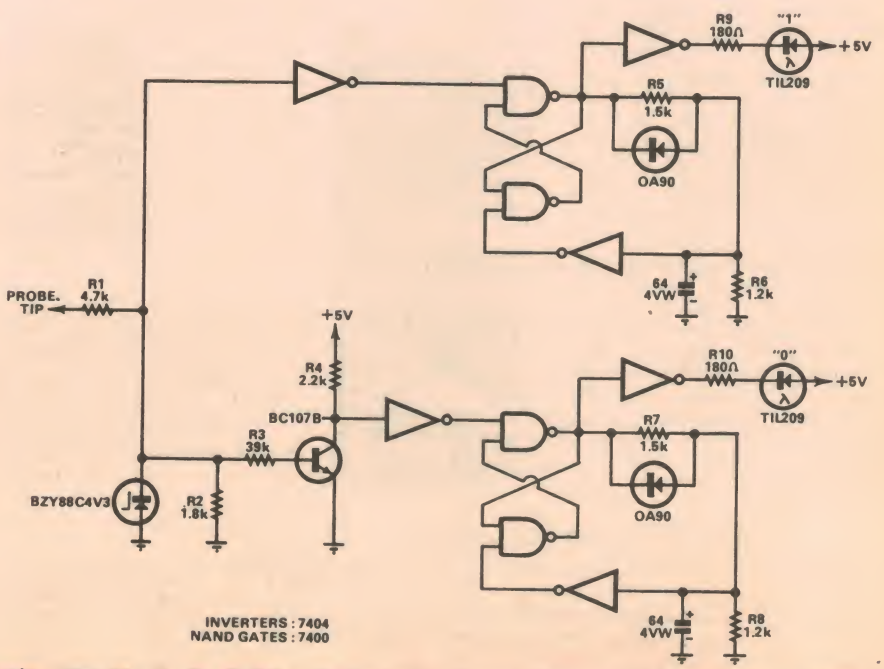
Improvements to logic probe

Recently I built up the logic probe which appeared in Circuit & Design Ideas for March, 1973. It worked very well but I consider that the over-voltage protection was inadequate and the input current required to drive the probe to logic 1 was excessive. Several circuit values have been changed and loading has been improved. The new values are shown on the circuit herewith.

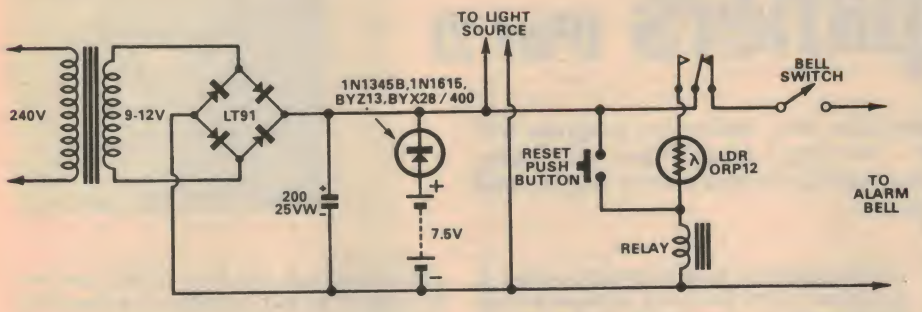
Some of the input currents have been reduced by a factor of 30. The modified circuit gives good input protection. At 20 volts the input current is only 1.6mA. If R1 is a ¼W resistor, the probe is protected against overload by more than 35 volts. The values of resistors R1, R2, R3 and R4 are quite critical as they determine logic 1 and logic 0 trigger levels. Resistors of 5 per cent tolerance should be used.

R1 determines over a narrow range, the minimum input voltage for logic 1. R3 determines over a narrow range, the maximum input voltage for logic 0.

The modified circuit requires only 300-400uA to drive it to logic 1. This is within the limits of the normal TTL output stage. When the input circuit is open, none of the LEDs will light. Current consumption at 5 volts is 40mA with open circuit inputs, 74mA with one LED on and 60mA with a pulse train. (By Mr G. R. Bolitho, 3 Herbert Street, Richmond, Nelson, New Zealand.)



Light beam intruder alarm



No doubt burglar alarms using door and window switches are very effective but equipping and wiring them takes many hours of work. The main feature of this circuit is that a locking facility is used, which transfers the operation of the relay to the reset circuit. The LDR does not participate in pulling in the relay, but merely holds it operated. The aim was to work over about 15m, possibly across two rooms and a hallway, so there would be a good chance the beam would be broken by an intruder.

Using 82mm dia lenses of 76mm focal length, a 4000 ohm relay, a 6.3V pilot lamp operated from a 1.5V cell and a 15V DC supply to the relay, the system worked reliably over 10m. The pilot lamp gave a dull glow that would be scarcely visible. Using full voltage on the pilot lamp, the system worked over a distance of 24m. An infra-red filter may be used as detailed in Electronics Australia for February, 1963.

Set up the lenses, LDR and light for the distance over which it is intended to be used. Adjust the light so that the distant lens is just covered with light. Adjust the LDR so that it is just covered with light. Measure the resistance of the LDR. Obtain a relay with a coil resistance as close as possible to this value. Care must be exercised to avoid exceeding the LDR rating of 200mW.

To set up the system press the reset button and then close the bell switch. If the beam is interrupted the bell will ring until the reset button is pressed again, or the bell switch is turned off.

A spherical reflector behind the lamp may be used to increase sensitivity. If the lenses used are plano-convex, the plane side should face the LDR or light source. References in RTV & H and Electronics Australia, which may help the reader are, September, 1961, September, 1962, and March, 1972.

(By Mr A. D. Fuller, 406 Pennant Hills Road, Pennant Hills, NSW 2120.)

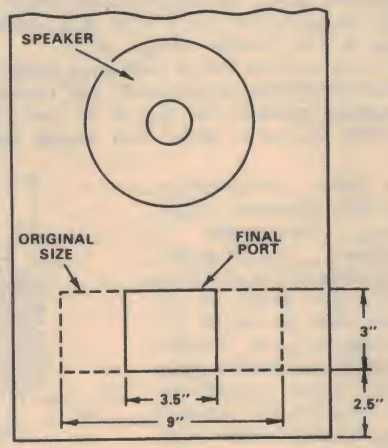
One-point-three speaker enclosure modification

I have a Playmaster One-Point-Three sealed speaker enclosure as described in July, 1969. Dissatisfied with the bass response of the system, I decided to try it as a vented enclosure.

As a starting point I cut an oversize rectangular hole in the front baffle and proceeded to cover it progressively while listening to program material. When the bass performance was considered at its best, the size of the remaining hole was marked and the unnecessary part of the hole was covered over. The final size of my port was 3in x 3½in. No doubt the position of the port is not critical, although the size of the port is important.

With this arrangement, I removed the original absorbent material and a curtain of this material is hung diagonally and given a quarter twist on the way down.

The main interest I think, is that the technique could be applied to other sealed enclosures deficient in bass. An interesting side effect is that intermodulation distortion at high volume on bass transients is reduced markedly, possibly due to the visibly reduced cone movement.



(By Mr J. East, Newrybar, NSW 2479.)

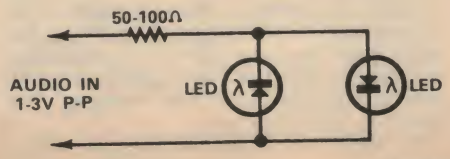
Editorial note: While this exercise worked out well for the author, it must be remembered that due to the many variables in loudspeaker characteristics, readers with other enclosures and different loudspeakers, the results may not always be satisfactory. It should also be noted that some loudspeakers with a highly compliant suspension may be damaged because of loss of the intended cone damping.

Zero-beat device using LEDs

Robert W. Stankus, W1GEY, has come up with a little gadget to align crystals to frequency. It enables visual alignment of 100kHz crystals to WWV simply and inexpensively. Two light-emitting diodes connected in parallel, but with opposing polarities, make a display for indicating zero-beat frequency.

The display can be driven by an AF voltage from the receiver's low impedance speaker terminals. A current-limiting resistor is included in the circuit and its value is not critical.

When the input frequency is more than 1kHz away from the zero-beat frequency, both LEDs appear to be on all the time. Each one is correctly biased for half a cycle of the input and shut off for the other half. As the input frequency comes within about 20Hz of zero-beat, the LEDs will flicker until zero-beat is reached. Both LEDs then go out and will remain out over the width of about plus and minus 5Hz. While the display is being used, the LED intensity will vary depending on the low frequency response of the receiver.



Programmed lighting

Recently I was given the task of providing lighting for the displaying of goods in windows and exhibitions. In addition to white spot and floodlighting, the requirement was to provide different coloured lights "programmed" so that they would give a constantly varying display.

After much experimenting, my attention was drawn to the Musicolour II, published in Electronics Australia in December, 1971, and January, 1972, and this helped to resolve the problem. Finally, I decided to pre-record tapes with continuous tones such that the different tones would actuate the lights accordingly. By using a considerable amount of imagination, it is possible to arrange and combine the three tones so that an excellent display is obtained.

A tape may be prepared by using a variety of tone sources. One method may be simply to use an audio generator but it would be easier to use three audio oscillators, one above 2kHz, one below 300Hz and one in between the two figures just quoted. These could be fed through a mixer and by varying both the frequency selection and the actual audio level, both colour and intensity may be varied. Other sources of tone may also be suitable, such as those from an organ, piano, etc.

From experience, it has been deduced that where the public has been induced to watch a display, no individual would stay for more than about 10 minutes. If a program is arranged such that it repeats itself, the duration of such a program could be about 12 minutes.

(By Mr T. J. Singleton, 12 Ella Street, Hull, HU5 3AY, England.)

Let's talk about amplifiers (Part 2)

Elementary Electronics

by Ross Tester

Following our discussion on simple amplifiers last month, we progress this month to amplifiers with higher power — the output stage. More specifically, our aim is to show the development of the transformerless output and the role of the emitter follower on this technology.

Early transistor amplifiers were not very different from their valve predecessors. In fact, when transistors first appeared, they were regarded merely as "substitute valves" and were put into the same types of circuits.

One of the most popular output stage circuits of the day was the "push-pull" arrangement in which two valves were used in various modes assisting each other. The most common mode was "class A" or, more usually, a minor variation of it, "class AB." Another mode, "class B," had also been used, but only in situations where efficiency and economy were more important than fidelity. With the advent of transistors there was a resurgence of interest in the class B mode.

We suspect many of our readers may not be too clear on the various classes of amplifier. You meet these terms a lot in electronics, so it might be worthwhile introducing them now:

A class "A" amplifier is one in which the active device (valve, transistor, FET, etc). is biased so it is turned on for the full cycle (360 degrees). The amplifier described last month was a class A amplifier, being biased to the mid-point, and remaining in operation over both positive and negative excursions of the cycle.

Class "B" amplifiers are biased so they operate for half the cycle (180 degrees) — either the positive or negative half cycle. The other half cycle is rejected.

Class "C" amplifiers are not used in audio work. The are designed to operate for less than 180 degrees of the cycle — sometimes only a few degrees. They are used in RF circuits, due to the extremely high efficiency attainable from them, and where the tuned circuits with which they are associated eliminate the gross distortion such a mode would otherwise generate.

There are other classes, such as AB, AB1, etc, but we will not concern ourselves with them. Suffice it to say they they operate "in between" the other classes.

Early transistor amplifiers employed the class B mode, the output pair being fed by a driver transformer and feeding into an output transformer. While valve amplifiers operating in the class AB mode had successfully substituted a simple valve circuit for the driver transformer, class B amplifiers, whether valve or transistor, still required a driver transformer. In fact, this configuration is still a very popular one for portable radios and similar devices.

We have already explained that a transistor (or valve) operating in the class B mode amplifies only one half of the waveform. Fairly obviously, this represents a gross distortion of the original waveform; one that would be quite intolerable. Class B operation is practical only because we use two transistors, arranged so that each one amplifies the half of the waveform rejected by the other.

A typical transformer coupled stage is shown in Fig 1. The relevant portion consists of a driver transformer (T1) a pair of PNP transistors (TR1 and TR2) and the output transformer (T2).

The driver transformer T1 has a single primary winding and a centre-tapped secondary. Another way of looking at the secondary is that it is really two windings, connected so as to supply two signals of opposite phase. The output transformer T2 may be looked at in a similar way, except that it is a "mirror image" of T1.

Let us assume that a sine wave signal is generated in the primary of T1 and that this appears between the top of T1 and the centre tap as a signal that swings first negative and then positive.

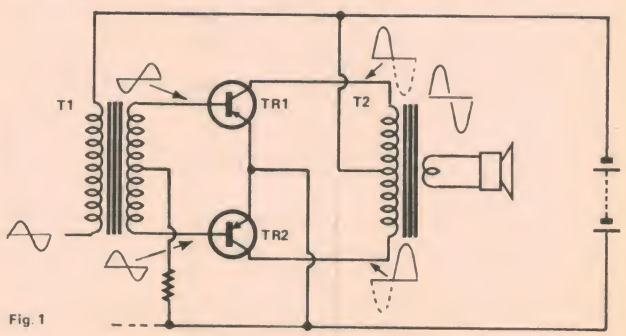


Fig. 1

A basic transformer coupled transistor output stage. Transformer T1 delivers out-of-phase signals to TR1 and TR2 so that both halves of the waveform are fed to the transistors, and handled by them, as positive going half waves. Transformer T2 reverses this situation so that a complete waveform is fed to the speaker voice coil.

Both transistors are operating under zero bias conditions, and draw little or no standing current. When the negative going half wave is applied to TR1 base, the transistor will commence to conduct, and continue to conduct through the remainder of the half cycle.

Thus, the half cycle will be reproduced in the collector circuit as current flowing through the top half of T2. This will be transferred to the secondary winding, the speaker voice coil, and ultimately appear as movement of the cone. (Say, outwards, then back to its rest position.)

Meanwhile the signal across the lower half of the winding has been positive going at the same instant, a condition which TR2 completely ignores.

When the signal in the top half of T1 swings positive, TR1 ignores it but, at the same time, the lower half of T1 is presenting a negative signal to TR2, which the latter handles exactly as TR1 handled the previous half cycle.

As before the signal will appear in the collector circuit, this time of TR2, and flow through T2 primary winding, the lower half this time. Again this will cause the voice coil to move but, because the current through T2 primary was in the opposite direction, the movement will be in the opposite direction. Say, inwards then back to its rest position.)

Thus both halves of the signal have been processed; one half by each transistor.

If the transistor was not biased to class B, but to class A or AB, the transistors would not take it in turns each half cycle, but would assist each other over the whole cycle, or parts of it. As a matter of fact, the name "push pull" came from this — one valve "pushed" while the other "pulled."

Transformer coupled amplifiers have some good features — the voltage swing obtainable from the transformer is high, and phase inversion is easy. However, one big disadvantage is the price. To obtain good frequency response an expensive transformer is required.

However, the basic transformer coupled amplifier remained in vogue for some time. In fact, it was not until the invention of an opposite polarity transistor — the NPN — that engineers were able to think seriously about a transformerless amplifier. The availability of two amplifying devices of opposite polarity was a completely new concept — there had never been anything like it on the valve scene.

Because the NPN and PNP transistors operate on opposite polarity waveforms a pair of them, fed with the same signal, will automatically process opposite halves of the signal, without the need for phase inversion. Thus the driver transformer could be eliminated.

The output transformer was something else again. Because of the opposite polarity of the two devices — one requiring a positive collector supply and the other a negative — the conventional output transformer arrangement was no longer practical. Some new arrangement was needed and if it could eliminate the ex-

pensive output transformer, so much the better.

In the conventional class B output stage the output transformer performs two main functions. One is to match the medium impedance of a conventional output stage to the much lower impedance presented by the speaker voice coil — typically 8 or 15 ohms.

The other is to combine the two half wave signals — one from each output transistor — in the correct phase so as to present a complete wave form to the speaker.

The first function, impedance matching, is most conveniently provided by our old friend, the emitter follower circuit. And, by making the load (the speaker voice coil) common to the emitters of both transistors, we can also satisfy the second requirement.

One of the most satisfactory ways to demonstrate how such a stage works (or any stage for that matter) is to set up a series of circuit "models" which we will describe.

These are very simple circuits which any beginner should be able to build. Only a few parts are needed; a small power transistor, a battery, a 0-10V meter, a pot, and a couple of resistors will get you started. If you can stretch it to two transistors, one PNP and one NPN, and two meters, so much the better. And if you can make one of the meters a centre zero type, so much better again. While this is likely to be a hard one for most readers, it may be available to school or other study groups.

Although these circuits may be regarded as basically DC arrangements — they are not intended to handle signals in the usual sense — we can, by a simple trick, simulate a very low frequency signal which will allow us to observe the behaviour of the stage in what is, literally, "slow motion."

Fig 2 shows our first model circuits; two emitter followers, one (a) using an NPN transistor and the other (b) using a PNP type. Either one will suffice, but both may be built if both transistors are available. Note that we have inverted one of the circuits (b), and the reason for this will become apparent a little later on.

One of the most important parts of the circuit is the pot connected between the positive and negative rails. By sweeping the moving arm slowly back and forth between the common rail and the active rail we can create a very low frequency AC signal at the transistor input (base) and note its effect at the output (emitter).

If only a single meter is available it should be connected as M1, between the emitter and the common rail; the negative rail in diagram (a), positive in diagram (b). If a second meter is available, connect it as M2, from the moving arm to the common rail.

First, let us demonstrate the basic action of the emitter follower; the fact that the voltage across the emitter resistor "follows" the voltage changes applied between base and emitter.

We start with the moving arm at the common rail end of the pot. In this position there will be zero volts applied to the base and there will also be zero volts indicated on meter M1 across the emitter resistor. Now advance the moving arm slowly. At first there will be zero volts applied to the base provided, it will be reading approximately 0.6V before M1 begins to read. After that,

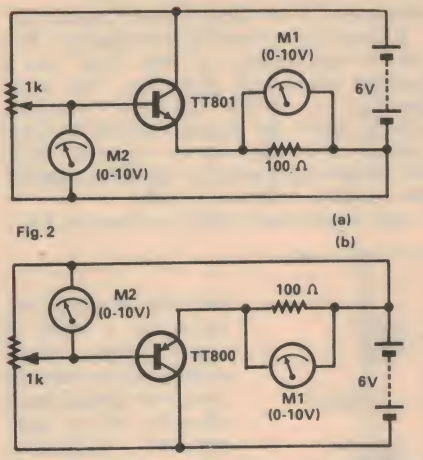


Fig. 2

Our first circuit model. It can be made up in either form, using an NPN or PNP transistor and will provide valuable practical demonstrations of transistor amplifier behaviour.

M1 will follow M2, but always 0.6V below it.

What causes this 0.6V difference? This is the voltage (approximately) which must be applied across any silicon transistor base-emitter junction, before current will flow. (The same applies to a silicon rectifier junction.)

An appreciation of this characteristic is important because, if suitable precautions are not taken, it can introduce severe distortion in the amplifier circuits we are about to discuss. Fortunately, precautions can be taken, and we will have more to say about this later on.

Meanwhile, there are more things we can demonstrate about the behaviour of this circuit. Suppose we set the moving arm so that M1 reads half the supply voltage (3V). We have now biased the transistor for class A operation. We could superimpose an AC signal of, say, 2.5V on the base circuit and it

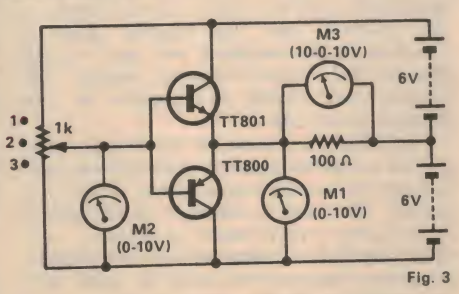


Fig. 3

Our second model. The two halves of Fig 2 have been combined to make a rudimentary class B output stage.

would be accurately reproduced in the emitter circuit.

We can demonstrate this in slow motion. Simply note the reading on M2 then vary the moving arm each side of this value by 2.5V and note the readings on M1 as you do so. This is what would happen — at a very much faster rate — if we applied a typical audio signal to the transistor base.

While class A operation is commonly used in the early stages of amplifiers, and can be used in the output stage, there are some objections to it in the latter position. The main one is that, with the bias set to the mid position as already described, there is a steady flow of current through the transistor at all times; whether it is handling a signal or not.

This represents a waste of power — particularly important in the case of battery circuits — and it generates heat in the transistor regardless of the signal condition. In the ultimate, it is the permissible heat rise which limits the amount of signal power which the transistor can deliver.

Now let us consider an alternative operating condition. Instead of biasing the transistor to the mid point, we do not bias it at all. This is class B operation. In the absence of a signal there is no current flow through the transistor, and no heat is generated. Also, unfortunately, there would not be proper amplification either. If an AC signal was fed to the base, only one half of the full cycle would appear across the emitter resistor. In circuit (a) the positive going half cycle only would be handled and in (b) the negative half.

But notice this: while either will handle one half cycle only, each will handle the half cycle which the other rejects. Thus, while (a) will accept a positive going half wave, and reject the negative going half, (b) will accept the negative half and reject the positive half. Is it possible that we could combine these two circuits? If we could we would have an amplifier which would handle both halves of the signal equally, yet draw no current in the absence of a signal. Furthermore, it will only ever draw current (and generate heat) in proportion to the strength of signal being handled.

We can do this — and Fig 3 shows how. Here the two emitter followers from Fig 2 are combined into a single circuit. (It will now be obvious why we inverted one of these.) The bases are tied together and therefore receive the same input signal. They also share the emitter load which, in practice, will be the speaker voice coil. On the other hand, each transistor has its own power supply.

This is our second "model" circuit and, as before, we have made provision to generate slow motion input signals; a pot connected between the positive and negative rails. We very strongly urge that you make up this circuit; ten minutes "fiddling" with it will teach you more about circuit behaviour than many hours of study alone.

If you have only a single meter, connect it as before (M1). If you have two, so much the better. For convenience of explanation, we have nominated three reference points on the pot: (1) is the extreme negative position, (2) is the mid position, and (3) the extreme positive position.

Start with the moving arm at (1). Under these conditions TR1 will be biased fully on — base connected directly to the collector rail. (TR2 is biased off.) Meter M1 shows the voltage between emitter and collector which, at saturation, will be about 0.7V for this type of transistor. (This voltage varies considerably with different type transistors.)

Now move the arm towards position (2). This will progressively reduce the forward bias on TR1, and the emitter-collector voltage will steadily increase — essentially in step with the voltage indicated on meter M2.

That is, until we approach within about 0.6V of position 2 on the pot. Then meter M1 will cease to move, even though we continue to rotate the arm. It will remain stationary until the arm has passed position 2 by 0.6V. Then meter M1 will start to move again.

This effect is most important. It is caused by the need for each base to be 0.6V above the voltage of the emitter before collector current will flow. Thus the output circuit is, in effect, "shut off" from the input circuit over a range of 1.2V and this constitutes a serious form of distortion. It is called "cross-over distortion" because it occurs as the signal crosses over from one transistor to the other.

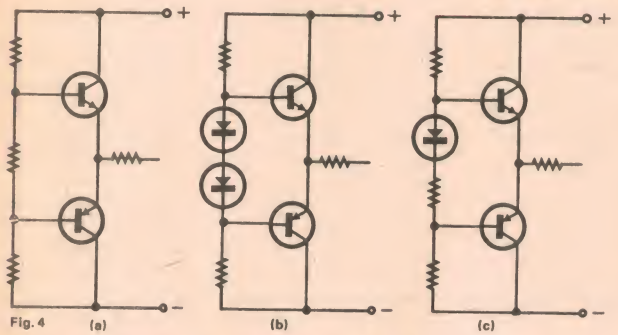


Fig. 4

Evolution of a bias network for a class B output stage. (a) is simple, but not able to cope with temperature changes. (b) is temperature conscious, but not able to be adjusted. (c) is a practical compromise.

When the moving arm was within 0.6V of position 2 TR1 ceased to conduct, while TR2 was not yet conducting. When the arm moves past position 2 by 0.6V TR2 starts to conduct, and meter M1 starts to move again. When the moving arm reaches position 3 TR2 will be biased fully on and its emitter will be within about 0.7V of the positive rail.

Another way of looking at the meter behaviour is that, initially, its positive terminal is close to the negative rail; within 0.7V of it. As the pot is moved from 1 to 3 the meter positive terminal moves, in effect, from the negative rail to within 0.7V of the positive rail.

Reverting to the cross-over distortion problem, this can be tackled in two ways, both of which are usually used. The more basic method is to provide a small amount of forward bias for the transistors, at least equal to the 0.6V junction difference which creates the problem. This creates some standing current and heat generation under no signal conditions, but these can still be kept quite low.

When the best bias compromise has been selected, any remaining distortion can be reduced to negligible proportions by means of negative feedback. This has the advantage that it also reduces distortion due to any other cause.

Fig 4 illustrates the evolution of a typical bias network. At (a) we have a very simple arrangement; a voltage divider system designed to develop, across the centre resistor, approximately 1.2V, or just sufficient to cancel the 0.6V for each base-emitter junction. Unfortunately such a simple circuit is not stable enough to be practical, particularly in regard to changing transistor characteristics with rising temperature.

Diagram (b) is a better suggestion. Here two silicon diodes are used to develop 0.6V each, or 1.2V total. This voltage would be highly stable in the face of changing supply voltage, and would also be temperature conscious and adjust itself to suit rising temperature. Ideally, the diodes would be thermally coupled to (mounted on) the transistor heatsink. Again this is not a practical circuit, since there is no means of adjusting the voltage to cope with the tolerances of the diodes and transistors.

A practical network is shown at (c). This uses a combination of one diode and a suitable amount of resistance. The diode develops a stable but heat sensitive voltage while the resistor allows the total voltage to be adjusted as required. While the resistor degrades the stability slightly, the result is quite acceptable.

Our final circuit model is shown in Fig 5.

Our circuits so far have shown each transistor supplied from a separate power supply; a pair of batteries for simplicity. While the twin battery idea is hardly practical, there have been a number of power operated amplifier designs based on a split power supply; positive and negative rails having the same voltage with respect to a common rail. The Playmaster 136, December 1972 used such an arrangement.

While this has a number of advantages for high quality amplifiers — including extended low frequency response — it cannot always be justified for simpler amplifiers where a more modest performance is adequate. For this we can use what is called an AC coupled output stage.

Fig 5 illustrates such a circuit and, if built up, will demonstrate how it functions. The main difference between this and the previous circuits is that the two 6V batteries previously used have been joined to make a 12V battery, and the emitter load is returned to the negative rail via a large electrolytic capacitor. As before, the emitter load would in practice be the speaker voice coil.

Two meters are shown in the circuit. M1 is a 0-10V meter as used in the earlier circuits and M2 is the centre zero meter mentioned earlier. We used a 1-0-1mA movement in series with a 1k resistor to make a voltmeter reading 1V either side of zero. Higher sensitivity movements could be used with appropriately higher series resistors. If a centre zero meter is not available, a conventional meter can be used, but the full effect of the deflection in one direction will not be shown.

This CRO pattern is an excellent example of cross-over distortion, being made by feeding a pure sine wave into the circuit of Fig 5. It also proves that this simple circuit will work — with limitations!

To set up the circuit adjust the moving arm of the 1k pot to approximately its mid position but, more precisely, until M1 reads half the battery voltage. This represents the no signal condition and indicates, quite obviously, that the 500F capacitor will be charged to half the supply voltage.

Incidentally, it is the process of charging the capacitor to this half supply voltage which causes the "thump" in the speaker at switch-on.

Now consider what happens when a signal is applied to either TR1 or TR2. A positive going half wave will cause TR1 to conduct, moving the emitter junction towards the positive rail. As a result the 100 ohm resistor will have a voltage applied to it and current will flow from the positive rail through the resistor in the process of charging the capacitor.

In the event that a negative half wave was involved TR2 would conduct and the emitter junction would move towards the negative rail. As a result the 100 ohm resistor would have a negative voltage applied to it and current would flow from the capacitor through the 100 ohm resistor in the process of discharging the capacitor. Note that this current flow would be in the opposite direction to that due to TR1 conducting.

We can simulate this for demonstration purposes by giving the shaft of the pot a quick twist in either direction from its mid point. The centre zero meter will flick momentarily one way or the other, according to the direction in which the pot is turned. By identifying the polarity of the two ends of the pot, it is possible to work out which movement causes the capacitor to charge, and which to discharge.

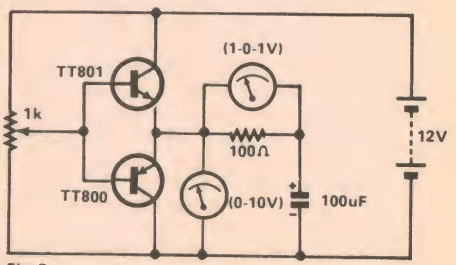


Fig. 5

While the divided power supply portrayed in the earlier circuits has a practical role, a single supply is often more convenient. This circuit shows how it is achieved.

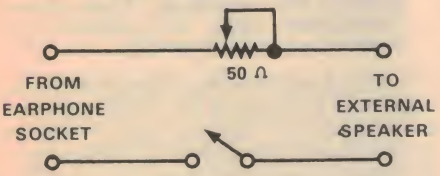
As the reader may realise, the process of charging and discharging the capacitor must mean that the voltage across this capacitor will rise and fall. It is important to realise that this is an undesirable situation; ideally this voltage should remain constant, with the whole of the signal voltage appearing across the load, or voice coil. In practice some of the signal voltage appears across the capacitor and this loss becomes larger as the signal frequency becomes lower, ie, the response of the amplifier fa'ls at low frequencies.

In practice we counter this by making the capacitor as large as possible or, looking at it another way, by ensuring that the impedance of the capacitor, at the lowest frequency to be handled, is small compared with the impedance of the load. A typical value for a practical amplifier would be 500 uF which, at 50Hz, has an impedance of about 6.5 ohms, compared with a typical

Elementary Electronics Ideas Worth Trying

Remote TV Volume Control

If you would like a remote volume control on your TV set, but hesitate to tamper with the wiring of a commercial set, the following tip may help. Many TV sets are fitted with an earphone socket, which usually cuts out the main speaker when the earphone is plugged in.



If an extension speaker is plugged into this, it can be fitted with a simple volume control and, if you wish, a switch as well. The volume control's function is obvious, while the switch can be used as an "ad killer".

My unit was built into a small plastic case and has about 20ft of cord from it to the TV set.

(Mr P. A. Thomson, 24 Hopkins Ave, Keilor 3036.)

Repairing a Cracked Board

A cracked printed wiring board may usually be repaired with a little care. If both the base and the copper are cracked, drill small holes through each run of copper, on opposite sides of the crack.

From thin tinned copper wire, make up a staple for each pair of holes. The staples should be just wide enough to bridge the two holes when the crack is closed. Make the sides of the staple fairly long.

Push the two halves of the board together, push one staple through the holes from the copper side, then gently twist the ends of the staple together on the component side, with a pair of pliers. Solder the twist, and clip off the surplus. Solder the tinned copper wire to the copper pattern. Where more than one staple is required, insert alternate staples from opposite sides.

(T.L., Christchurch, New Zealand.)

Cable Jacket Remover

There are many occasions when it is necessary to remove the outer vinyl plastic covering from a multi-conductor cable. A fast and easy way of doing this with no risk of damaging the insulation of the conductors is to use a dressmaker's seam

ripper, as shown. Simply slip the end of the seam ripper under the outer covering, and push. Zip! It slices the jacket like a knife through soft butter. — Hugh Gordon.

(This suggestion appeared originally in "Radio-Electronics," November, 1973. Ed.)

Improvised Coil Former

When building the 1967 All Wave Two, I could find only one ¾in coil former, so the other two were made from old 12 gauge cartridge shells. A hole was drilled in the brass section and a bolt inserted through this to mount it on the chassis.

(Mr W. Stringer, Government Rd, Gulnare, 5471.)

Elementary Electronics — continued

voice coil impedance of 16 ohms.

While we have shown a 500uF capacitor, there is some advantage in making this as large as possible for purposes of demonstration. We tried a 10,000uF unit which was available and the improved response to the very low frequency signals, which our pot twiddling represents, was quite marked.

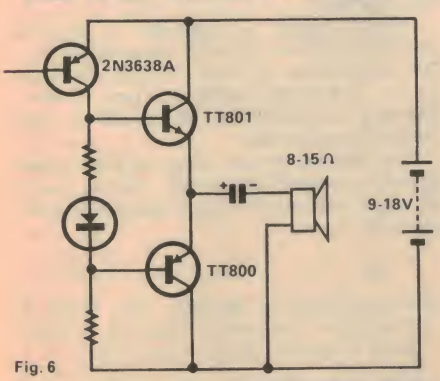


Fig. 6

A practical output stage evolved from Fig 5. Although the load and capacitor positions are transposed, this makes no difference to the circuit's operation.

Our circuits so far have been explanatory rather than practical. A practical circuit, embodying the points discussed so far, is given in Fig 6. In fact it is a simplified version of the output stage used in several of our projects, including the "Audio-Mate" described in March 1972. Next month we hope to describe a similar, but somewhat simpler amplifier as a constructional project.

In the meantime, compare Fig 6 with the earlier diagrams and digest what you have learned from our circuit models. By the time you tackle next month's project you will not only know how to build it, you'll know how it works!

VARIETY FARE

REVIEWS OF OTHER RECORDINGS

Devotional Records

FOLK HYMNAL. In Sound For Singalongs. Stereo, Singcord ZLP-834S. (From S. John Bacon Publishing Co Pty Ltd, 119 Burwood Rd, Vic 3125).

An unusual album, this: The title is actually that of a hymnal in the Singspiration series published by the American Zondervan Corporation. The twenty-one hymns and choruses on the two sides are taken from the hymnal and are identified by number so that anyone with the book can turn up the words and sing along. Also stated is the number of preliminary musical measures, allowing a conductor to lead the singalong, if desired.

A further interesting aspect is that the chorus and accompaniment are on the right and left channels respectively, so that either can be selected by simply rotating the amplifier balance control.

But, if you just want to listen, you can ignore all this detail and simply enjoy the sound. Without arguing the precise connotation of "Folk", the hymns are of more recent vintage; happy, rhythmic and tuneful and with a potential appeal to the whole family. Some you will know for sure: Happiness Is The Lord — Heaven Came Down — I Have Decided To Follow Jesus — Kum Ba Yah . . .

The sound is very clean and, because of the virtually complete left/right separation, the record really spreads on a 4-channel system. Recommended. (W.N.W.)

COUNTRY WESTERN HYMNAL. In Sound For 3 Singalongs. Stereo, Singcord ZLP-895S. (From S. John Bacon Publishing Co Pty Ltd, 119 Burwood Rd, Burwood, Vic 3125).

This is a companion disc to "Folk Hymnal", reviewed above. It features a generous twenty-four hymns and choruses from a Singspiration hymnal, listing titles, numbers, musical intro measures, all aimed at making it easy for an individual or a congregation to sing along with the record. For the same reason, the chorus and accompaniment is recorded on different sides of the stereo pair so that they can be separated with the balance control.

The difference between "folk" and this kind of C&W is not immediately obvious. In both albums the hymns and choruses are of the in-between variety, neither old nor mod, but all tuneful and gently rhythmic.

Examples are: Put Your Hand In The Hand — Reach Out For Jesus — Jesus And Me — His Name Is Wonderful — Burdens Are Lifted — We'll Talk It Over — Springs Of Living Water — Mansion Over The Hilltop.

These and others like them are old enough to be part of the adult scene and should make welcome family listening. On this basis "Country Western Hymnal" must also be recommended. (W.N.W.)

SHOW ME. By Jimmy and Carol Owens. Stereo, Pilgrim JLPS-181. (From S. John Bacon Publishing Co Pty Ltd, 119 Burwood Rd, Burwood Vic 3125).

Yet another Christian Musical, "Show Me" examines the challenge to traditional church missionary outlook of the strange people in the local park. The viewpoint of this latter group is expressed, predictably, in rock; that of the little old "establishment" ladies in lyrics that have strong G&S overtones.

Like many such presentations, it contains a mixture of truth and overstatement; of entertainment, challenge and provocation. But, of course, it does make a point, albeit an often-stated one nowadays: there are age and culture barriers in our society which should be faced and worked on, rather than just talked about.

Although the jacket identifies the song and dialogue segments, the tracks are not separated in the recording and the album is intended to be heard for what it is — the sound recording of a complete stage presentation, which begins with complete estrangement and ends with mutual understanding. The traditional happy ending?

If you have an interest in Christian musicals, particularly with a youth emphasis, this one could be for you. Conversely if your preference is for more traditional devotional fare, you mightn't be inclined to stay with "show me" long enough to get a feeling for what Jimmy and Carol Owens are trying to say. (W.N.W.)

GODOFALLOFUS. The New Hope Singers. Stereo, Light LS-5590-LP. (From Sacred Productions Aust, 181 Clarence St, Sydney and other capitals).

The 11-strong New Hope Singers have the expressed intention in this album of communicating their Christian faith. I must be frank: the only thing they communicated to me was an urge to turn them off! Granted, I would not have been in the target group and you may not be, either. This is pure pop-scene sound; if it turns you on, fine! Whether this is synonymous with comunicating a basic faith is another matter.

But enough of that. The titles are: Godofallofus — Where Does It Hurt? — Minstrel Man — Get Love In — The Great Financial Revival — Eastside Morning Glory Sunday Sorority — Give A Little Bit — Friend — Quiet Place — Jesus Made Me Higher.

If you should hear it, and like it, and gain from it, that's fine. But Godofallofus is not for this reviewer! (W.N.W.)

Instrumental, Vocal and Humour

AN EVENING OF CLASSICAL FAVOURITES. Vol 8. Various orchestras. Stereo, Fontana (Phonogram) 6540-141.

One can be quite snooty about records with such a title but the simple fact remains that this is volume 8 of a series, of all which are presumably still current. Fontana certainly aren't issuing them just to fill up its catalogue. But, in any case, in a world which abounds with movie themes and pop, is there anything reprehensible about preferring melodies, orchestras and artists which relate to the classical scene?

Volume 8 contains the following favourites, snippets, lollipops; call them what you like: Barcarolle (Offenbach) — Czardas (Monti) — Heart Wounds (Grieg) — Souvenir (Drdla) — Berçeuse (Godard) — Ich Liebe Dich (Grieg) Perpetuum Mobile (Strauss) — Minuet (Boccherini) — Nuns' Chorus (Strauss) — Ave Maria (Gounod).

The items are played by European orchestras and conductors, the details being much more copious than I can accommodate here.

The sound throughout is clean and any differences in the acoustic environment for the various tracks is of no consequence. This is not for classical buffs, of course, but those who are not already overstocked with this kind of material will enjoy it. (W.N.W.)

★ ★ ★

MUSIC FROM THE GREEK ISLANDS. Tacticos and his Bouzoukis. Stereo, Axis 6045.

As the notes point out, the films "Zorba The Greek" and "Never On A Sunday" sparked off a whole new interest in Greek music, and the bouzouki in particular. In this album bouzouki provide the dominant sound but weight is provided by guitar, piano and bass. The result is a highly listenable album with a pleasant difference. The tracks:

Zorba's Dance — That Boy — Get Up, Dance My Doll — Get Up, Dance Sirtaki — The Girl From Faliron — Folk Dance In 9/8 — Never On Sunday — Gone, Gone — Poverty — Rowing Boat By The Shore — My Tears Are Burning.

The quality is very clean and the sound spreads around pleasantly when played through a matrixed quadraphonic system. (W.N.W.)

★ ★ ★

HIGHLIGHTS IN BRASS. The Band Of Yorkshire Imperials Metals. Stereo. Astor Gold Star Series GGS 1360.

This very pleasant record brings back child-hood memories of band concerts in the local park on summer weekends. This particular group is in the best tradition of

Reviews in this section are by Neville Williams (W.N.W.), Harry Tyrer (H.A.T.), Leo Simpson (L.D.S.), Gil Wahlquist (G.W.), and Norman Marks (N.J.M.).

British "works" bands. They play seven selections with consummate skill, with such titles as: Prelude for an Occasion — Festival Music, Overture, Romance, Impromptu — Bandology — Rhapsody in Blue — Rondo from 4th Horn Concerto — American Patrol — Una Voce Poco Fa.

My only criticism of the record is in the quality department, as the treble is somewhat attenuated. But don't let this spoil your enjoyment. (N.J.M)

★ ★ ★

THIS IS THE BIG BAND ERA. Various bands. Mono, RCA 2-record set VPM-6043. ($8.40).

When I settled back to listen to the first record of this set, I was astounded to hear the strains of Aquarius in unmistakeably wide range sound. Somehow the wrong disc had found its way into my review set and I never did get to hear record 1 which covers the period 1928 to 1939. But at least I can tell you that it is available normally — original recordings re-mastered on to microgroove of Benny Moten, Tommy Dorsey, Benny Goodman, Bunny Berigan, Artie Shaw, Ziggy Elman, Lionel Hampton, Charlie Barnet and Glen Miller.

Record 2, which I did hear, carries on from Earl Hines (1940) to more up-to-date recordings by some of the conductors already mentioned, plus Erskine Hawkins, Duke Ellington, Count Basey and Larry Clinton.

The double fold jacket carries notes on the conductors and lists many of the personnel. All told, the album holds plenty for those with an interest in the big band era.

The sound quality of the recordings I was able to hear lacks the sparkle and the spread of modern technology but in otherwise clean and adequate to display the talents of an earlier generation of fine musicians. (W.N.W.)

★ ★ ★

SAMMY KAYE, Creator of Swing and Sway featuring If You've Got The Time. Quadraphonic, Project 3 (Festival) PJL-34744.

Bright, yet very easy on the ear is this new recording from the Sammy Kaye Orchestra, in association with the vocal group, the New Kaydets. If you want to take a more informed interest in the orchestrations, the jacket notes briefly outline the basic arrangements for each of the numbers: If You've Got The Time — I'd Like To Teach The World To Sing — We've Only Just Begun — You've Got Me Crying Again — The Good Times Go Right On — For The Good Times — Those Were The Days — The Beat Goes On — Why Don't We Do This More Often — Everything Is Beautiful.

Project 3 have a reputation for clean sound and this one is no exception. This, plus some well arranged duetting across the room, add up to excellent entertainment of the 4-channel kind. Good middle-of-the-road listening. (W.N.W.)

★ ★ ★

CONTRASTS. Featuring the Unique Quadraphonic Cordovox of Valentino. Quadraphonic, Astor Quad-1020.

This new album is a real wow — but you'd better read on so as not to misunderstand the meaning of my remark. The Cordovox looks like an accordian and has a fair complement of the usual accordian reeds. However, it also has quite a lot of electronic circuitry crammed in, so that it is virtually a portable electronic organ as well. At least the portable part is portable! Attached to Valentino's Cordovox are four 18in speakers, eight horns, two Leslie tone cabinets, several hundreds of amplifier watts, a microphone and PA system and an array of foot switches to control the system.

With all this, over-recording and quadraphonics, Valentino manages to sound like a full combo as he plays: Trumpet Voluntary — Musette Melody — You're A Lady — If — Ooh-Wakka-Doo-Wakka-Day — Love Story — Alone Again Naturally — Godfather Theme — Lara's Theme — Love Is A Many Splendoured Thing — Who Was It — My Way.

Back to the wow: Valentino uses wow by the cartload in some of the stanzas, along with double vibrato and Leslie that leaves true pitch far behind. If you happen to be allergic to this kind of thing — as I am — don't say you weren't warned. On the other hand, some of the tracks on side 2, over-recorded against his own piano, are pretty straight rhythm. After all, he does call the album "Contrasts".

Valentino is a very accomplished entertainer. His sound is unusual and very well recorded. Whether it's your kind of sound is another matter. Best you sample a few tracks and find out. (W.N.W.)

★ ★ ★

THE SYNTHESISER SOUND MACHINE. The Fantastics Pikes Somerset Sonic Stereo 9044 Astor release.

It is difficult to classify this type of presentation of hit tunes, since the Moog Synthesiser has been around long enough to be no longer a novelty. In a way, this record tends to suggest otherwise. As a demonstration of some of the wide range of sounds, musical and otherwise, available from these instruments it is interesting, but as music to listen to it fails to excite. The technical quality is excellent, with a dozen titles including: Mouldy Old Dough — Boccherini's Minuet — The Good, The Bad and The Ugly — Popcorn — House Of The Rising Sun — Ghost Riders In The Sky — Telstar. (N.J.M.)

★ ★ ★

HAMMOND HAPPINESS. T. W. Ardy with the orchestra of Hans Bertram. Polydor stereo 2371 045.

A great record to create a party atmosphere. Swinging arrangements and really good sound quality from Polydor. There are 28 tunes in all, presented in medley fashion.

Some of the tunes presented are: I Want To Be Happy — That Old Black Magic — You Are My Sunshine — Proud Mary — My Golden Baby — Oh Happy Day — Get Happy — Charmain. (L.D.S.)

MILLION SELLERS, from Broadway and Hollywood. 101 Strings. 3-Record boxed set. Stereo, Alshire (Astor) SPS 3-107.

The 101 Strings orchestra should need little introduction these days, although one should perhaps remark that their style now is to inject quite a bit of brass and rhythm into the basically string sound.

With six sides in this boxed set, one would imagine that the purpose is to pile them on the changer and let them provide music while you work. As the title suggests, the music is an anthology of best sellers from the shows. To quote a few:

If I Were A Rich Man — Theme From Love Story — Raindrops Keep Falling On My Head — Theme From Airport — Superstar — As Long As He Needs Me — Climb Every Mountain — Lara's Theme — Impossible Dream — High Sierra and so on.

Of relatively recent vintage, the recordings are wide range and well spread and lend themselves to quadraphonic presentation.

A box full of pleasant background sound, if you need it. (W.N.W.)

★ ★ ★

GOLDEN HOUR: REMEMBER WHEN, Vol 3. Les Brown and Charlie Barnet's Greatest Hits. Astor Golden Hour series GH812.

This record does an excellent job of recreating the Big Band sound of the thirities and the fourties with twenty favourites like: Sentimental Journey — Stompin' at the Savoy — Twilight Time — I've got my love to keep me warm — Blue Moon — Skyliner — Charleston Alley — Pompton Turnpike — Cherokee.

The quality leaves a little to be desired, probably due to groove amplitude problems caused by packing an hour onto a twelve inch LP but, if you like the sound, this should not worry you. There are two orchestras involved, Charlie Barnet's and Fancis Bay and both use some fresh arrangements to good advantage. (N.J.M.)

★ ★ ★

THE WAY OF LOVE. The 50 Guitars of Tommy Garrett. Stereo, United Artists (Festival) SUAL-934571.

Completely without ostentation, this album by Tommy Garrett is packaged in a jacket printed back and front in muted tones, with little more in the way of information than the song titles. In a way, the sound is muted, too, but it is smooth and restful and the perfect background to an easy chair, and a late evening cup of coffee.

But 50 guitars? Forget the phrase. Most of the guitarists must have been on holidays, or they've taken up other instruments instead. They play:

Strictly for nostalgia

THE GOLDEN AGE OF THE HOLLYWOOD MUSICAL. Original soundtrack recordings, created by Busby Berkeley. Mono, United Artists (Festival) L-34777.

As a very young man, I had a small collection of "Gold Digger" records which I used to check the audio systems of console receivers coming off the assembly line. I thought they were pretty good. That impression might have lingered if Festival had not sent me this microgroove re-issue. What limitations were overlooked in those days in the enthusiasm for the talking screen!

Yet, this double-fold album, with its clips of scenes from "The Gold Diggers of 1933" — and 1935 — "Footlight Parade" and "Dames" will come as an eloquent reminder of the immediate post-depression period and the early musical spectaculars from the Warner Brothers' Studio.

Remember: We're In The Money & I only Have Eyes For You — My Forgotten Man — 42nd Street — By A Waterfall — Shanghai Lil — Shadow Waltz and Lullaby Of Old Broadway?

And remember: Ruby Keeler, Dick Powell, Joan Blondell, James Cagney, George Raft? If you do, this one will certainly take you back to that vibrant, enterprising era of film making. (W.N.W.)

VARIETY FARE

Summer of '42 — Without You — Precious And Few — It's Impossible — Velvet Madonna — Brian's Song — How Can You Mend A Broken Heart? — The Way Of Love — Gipsy's, Tramps and Thieves — Broken Hearted Lullaby — American Pie — Living In A House Divided.

Looking at the titles, something seems to have gone wrong with the romance — but certainly not with the sound and the quality. (W.N.W.)

★ ★ ★

AKKORDEON POSP 2. Will Glahe, Accordian and Rhythm. Decca stereo SKLA 7702.

A rave review is warranted for this record. Great music and swinging arrangements. And the recording quality is excellent. What more can you want? There are no less than 28 songs presented in medley form.

Some of the songs presented are as follows: Fiesta Mexicana — I'm On My Way — Yellow Boomerang — Crocodile Rock — The Mouth Organ Boy — Sunshine Lover — Mama Loo — So Long. (L.D.S.)

★ ★ ★

ARIAS I LOVE. Maria Callas, with various artists and orchestras. His Master's Voice, Stereo OASD. 7575.

Maria Callas has selected these tracks from earlier recordings. She has certainly demonstrated here no desire to concede to popular taste and, except for the famous "O Care Nome" aria from "Rigoletto", there are none of the titles one sees time and time again in "best loved" and "highlights" recordings. The titles: Dei Tuo Figli" from Cherubini's "Medea" — (1) Tu Che Invoco, (2) O Nume, Tutelar, and (3) Caro Ogetto, all from Spontini's "La Vestale" — Morro, Ma Prima in Gazia, from Verdi's "Un Ballo in Maschero" — (1) Ah! Non Credea Mirarti, and (2) Ah! Non Giunge, from Bellini's "La Somnambula".

Maria Callas has not always come over well on disc, and I believe that much of her stage success was due to her dramatic skill. However, her admirers will find little or nothing to complain about here, where the singer has chosen carefully to present herself in the best possible light. The sound is distinctly dated, however, and the stereo appears to be of the "electronically reprocessed" variety. (H.A.T.)

★ ★ ★

HARRY SECOMBE FAVOURITES. Fontana stereo 6870 590.

Harry Secombe has certainly wrought a great change in his entertainment career. He has changed from a very successful comic and developed as a fine tenor. His popularity can be judged by the great reception he had at his recent Opera House appearance. For this reason, there should be no problem selling this album which has been released to coincide with his current visit to Australia. Record quality is okay. And the price is right at just $2.75.

Twelve tracks are featured: Climb Every Mountain — Hello Young Lovers — Song Of The Vagabonds — If I Loved You — Stranger In Paradise — Make Believe — Love Is A Many Splendored Thing — Wonderful Copenhagen — Three Coins In The Fountain — You Stepped Out Of A Dream — Love Walked In — Eternally. (L.D.S.)

FRANK IFIELD. Country & Western singer. Interfusion stereo L34988.

I must admit I've always had a soft spot for Frank Ifield and I've always remembered his most popular song "I'll Remember You". So I was glad to review another of his albums. Good straight singing with lyrics you can actually understand. Not at all like some of the latest vocalists. Recording quality has a slight edge to it but its not really obtrusive.

Twelve tracks are presented: Someone To Give My Love To — California Cotton Fields — Say Goodbye To Angelina — Don't Forget I Still Love You — Him Big Top Me The Clown — Till I waltz With You Again — Paint The World — Silver Wings — I Cry My Heart Out For You — Why Cant People Be People — My Happiness — Country Comfort. (L.D.S.)

★ ★ ★

THE GREAT SERENADES. Kenneth McKellar. Decca, Stereo SKLA 5160.

The word "serenade" seems to have inspired many composers to produce some of their finest melodies, and the collection of 13 presented here are very pleasant listening indeed, a pleasure to which Kenneth McKellar's fine tenor voice contributes in no small measure.

You will surely know most of these: Marie, Marie! — Starlight Serenade (Heykens) — A Mezzanotte (Donizetti) — Schubert's Serenade — Se il Mio Nome (Rossini) — Serenata (Toselli) — O del Mio Amato Ben (Donaudy) — Kalinka — Harlequin's Serenade (Leoncavallo) — The Lighted Window (Megio) — Serenade from "Frasquita" (Lehar) — Berceuse de Jocelyn — Serenade from "Student Prince" (Romberg). This modern decca recording is of excellent quality. (H.A.T.)

BILL COSBY LIVE AT MADISON SQUARE GARDEN. MCA stereo MAPS 6998 FOR ADULTS ONLY. Bill Cosby. MCA stereo MAPS 5325.

Bill Cosby fans will be pleased to know of these two recent album releases. They contain some material from his recent tours. Don't ask me to suggest which one is the best. I laughed all the way through both of them. Bill's insights into bringing up children and marriage are just incredible — and unspeakably funny. If you're a fan of his you should get at least one of these albums. (L.D.S.)

★ ★ ★

MILLION SELLERS, from Broadway and Hollywood. 101 Strings. 3-record boxed set. Stereo, Alshire (Astor) SPS 3-107.

The 101 Strings orchestra should need little introduction these days, although one should perhaps remark that their style now is to inject quite a bit of brass and rhythm into the basically string sound.

With six sides in this boxed set, one would imagine that the purpose is to pile them on the changer and let them provide music while you work. As the title suggests, the music is an anthology of best sellers from the shows. To quote a few:

If I Were A Rich Man — Theme from Love Story — Raindrops Keep Falling On My Head — Theme from Airport — Superstar — As Long As He Needs Me — Climb Every Mountain — Lara's Theme — Impossible Dream — High Sierra and so on.

Of relatively recent vintage, the recordings are wide range and well spread and lend themselves to quadrophonic presentation.

A box full of pleasant background sound, if you need it. (W.N.W.)

Jazz and Rock . . .

SOLID GOLD ROCKING MUSIC. Various artists. RCA Camden stereo CXS 9501. 2 record set $5.25.

For those old bodgies and swingers whose stovepipes are now too small and whose hair oil has solidified here is a 2-record set to help them remember how it was in their day. Somehow, though, the artists seem to lack the vigour that I remember them having. Either I am getting older or the various performers could have put a little more "oomph" into their delivery. Sound quality is okay and you get a lot of tracks for your $5.25.

Here are some of the 24 tracks: Sugar Sugar — Be Bop Alula — Whole Lotta Shakin' Goin' On — Fire — Get Back — Lawdy Miss Clawdy — Jailhouse Rock — Sweet Sixteen. (L.D.S.)

★ ★ ★

ON WITH THE SHOW. Sherbet. Infinity stereo L 35007.

It has taken Australia's top rock band (they won the Battle of the Sounds in 1972) a long time to getting around to their own material.

This LP has mostly original material written by Sherbet members Clive Shakespeare and Garth Porter. Their years of playing the hits of others has given them a confident style of their own.

The LP is planned like a show, with an introductory number "We Can Make It Right" all the way through to a farewell track in which the band members are farewelled. There is a comedy track "Jungle Jiver" which is one of the best novelties I've heard by a local group.

"Cassandra" is the most polished track and "Chicago", a ten-minute version of the Graham Nash composition, is the one with the guts in it. Besides Shakespeare and Porter, Sherbet members are Daryl Braithwaite, Alan Sandow and Tony Mitchell. Ern Rose recorded them at Armstrongs in Melbourne. (G.W.)

★ ★ ★

PRUSSIAN BLUE. Richard Clapton. Infinity stereo L34956.

It's a matter of what you are looking for and song-writer Clapton is exploring the meaning of life in a number of rock-oriented songs.

There is a theme of travelling and moving on in the songs, reflecting Clapton's own travels over the past five years.

The La De Das and guitarists Glenn Cardier and Mike McClelland were among the musicians who worked with Clapton on the album.

"Last Train to Marseilles" is the most successful track although it seems unfair to select it above others.

"I Wanna Be a Survivor" is particularly good, being Clapton's reflections after a period living at Sydney's Kings Cross. This is an album which is going to stand up for some time. It was produced by Richard Batchens and recorded at Festival Studios in Sydney. (G.W.)

★ ★ ★

VOLCANIC ROCK. Buffalo. Vertigo stereo 6357 101.

The opening number "Someday Sunrise" sets the tone for this high-volume rock record made by David Tice (vocals), John Baxter (guitar), Peter Wells (bass guitar) and Jimmy Economou (drums).

The disc appears to contain the material needed to provide high level sound at home, provided you can have the amps and emoh ruo can stand it.

A hypnotic beat and slashing guitar runs back Tice's hoarse, urgent vocals.

Reproduction of electronic music through an electronic system is a modern phenomenon and engineers seem to be getting better at it. Wahanui Wynyard recorded Buffalo for this session at United Sound, Sydney. I doubt if Buffalo would sound as good in the flesh as they do from the LP. (G.W.)

★ ★ ★

POP GOES GRAEME BELL ALL STARS. Festival stereo L 25079.

Graeme Bell and his group blow some jazz improvisations on pop tunes of the day including "Tie a Yellow Ribbon", "Candy Man" and "Daisy a Day".

I suppose it is because of their country music origins, but it is surprising how many of today's pops lend themselves to a dixieland treatment. The simple chords of country music have a lot in common with jazz.

Members of the All Stars are Jim Saunders (trumpet), Paul Furniss (reeds), John Costelloe (trombone and tuba), Laurie Thompson (drums), Harry Harmon (electric bass and tuba), Keith Harris (banjo and guitar) and Bell on piano.

This isn't a disc for the jazz heavyweights but I bet it will enliven many a party with its wonderfully relaxed jazz spirit. (G.W.)

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PRODUCT REVIEWS AND RELEASES

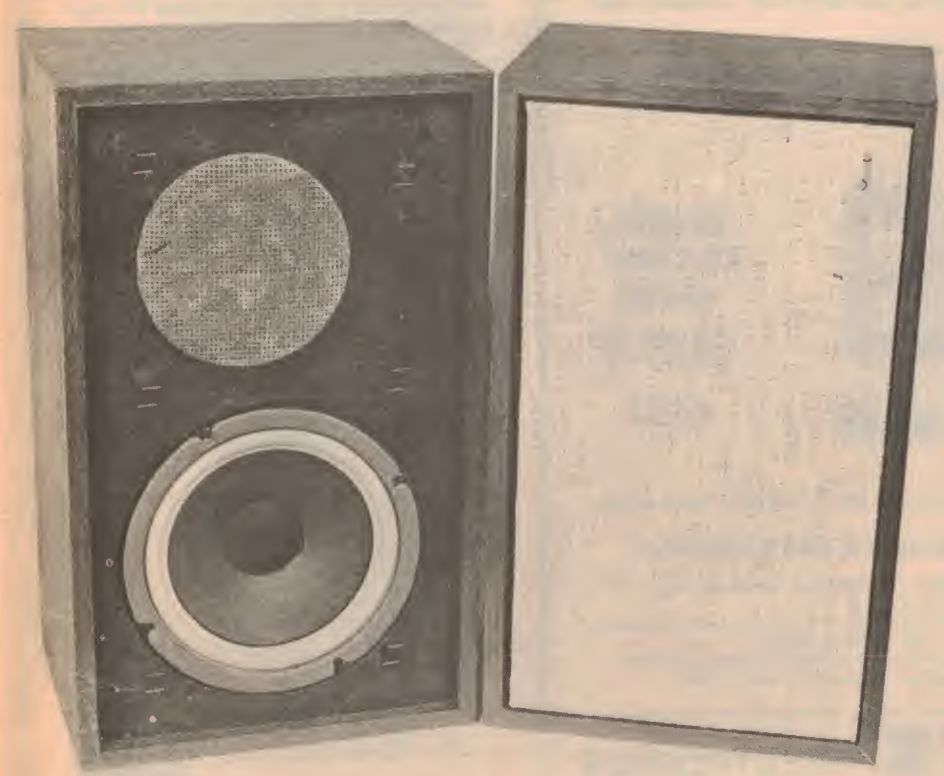
Jensen Model 2 Loudspeaker System

Jensen Sound Laboratories is a new name to the Australian hifi market but they are a well-known loudspeaker manufacturer in America. In this review we test the Jensen Model 2, which is a modestly sized two-way loudspeaker system.

Dimensions of the enclosure are 280 x 463 x 210 mm (w x h x d). The enclosure is rigidly made from the now usual compressed particleboard, and finished with a washable plastic woodgrained material. On the rear panel, the connection terminals and tweeter level control are recessed so that the cabinet can be positioned right against a wall.

Low frequencies are handled by a screen may also have an effect on the response of the tweeter but it did not appear to be removable, so we cannot tell. The loudspeakers are covered in normal use by the grille cloth, which is stretched over a wooden frame and held in place by Velcro tabs.

The cross-over network consists of a non-polarised electrolytic capacitor and a ferrite-rod cored inductor, plus a wire-



"woofer" with a nominal diameter of 8 inches (actually 207mm) which has a foam roll surround. Effective cone diameter is 145mm. The "spider" (voice coil suspension system) is quite large with a diameter of about 100mm while the voice coil appears to be about 30mm in diameter. The loudspeaker has a large ferrite magnet and a pressed steel chassis.

High frequencies are handled by a tweeter which has an alnico magnet and an effective cone diameter of about 80mm. The tweeter is "hidden" or protected by a fabric-covered wire-mesh screen. This wound potentiometer — the tweeter attenuator mentioned earlier. These components are mounted on the inside rear panel of the enclosure. The enclosure is partially filled with an acoustic damping material to control the resonance of the woofer. The enclosure is completely sealed — a so-called infinite baffle.

An infinite baffle enclosure usually has a single impedance peak at the low frequency resonance of the system. And so it was with the Jensen Model 2, which is a nominal 8 ohm system. System resonance was at 70Hz which resulted in an impedance peak of 50 ohms. Above 70Hz the impedance drops and then rises slowly with increasing frequency until it drops again at the crossover frequency — which appears to be 1500Hz. At this point the system impedance is at its lowest value of a little less than 5 ohms. Above 1500Hz the system impedance again rises gradually with increasing frequency.

All this means that the Jensen Model 2 should cause no matching problems with the majority of solid state amplifiers.

Tested with a sine wave oscillator and good quality power amplifier we found the response of the Jensen Model 2 system to be quite strong in the region from 90 to 150Hz, which means that there is little need for bass boost in most situations. In fact, if more than a little bass boost is applied there is a tendency for the system to have "one note" bass. Lower down, the response dipped and then picked up in the region of 40 to 45Hz, dropping off rapidly thereafter.

In the midrange, the system was quite smooth although it sounded a little "reedy" in the region of the crossover frequency, ie, from 1kHz to 2kHz. This may be caused by "crossing over" to the tweeter at too low a frequency and hence exciting the tweeter's natural resonance. Above 2kHz the response was well maintained to 10kHz and tapered beyond that.

We found that for best results on music the attenuator should be set for maximum output from the tweeter.

Overall sound quality is pleasant, with no vices — although we would have preferred a more extended high frequency response from the tweeter and perhaps a little smoother bass even at the expense of some bass output. We have no information on power handling but the system appears to handle the output of amplifiers up to 30 watts without any trouble.

Recommended retail price of the Jensen Model 2 is $169 per pair. They can be demonstrated at the showroom of the Australian distributor, B.J.D. Electronics Pty Ltd, 190 Willoughby Road, Crows Nest, NSW and are available from selected audio retailers throughout Australia. (L.D.S.)

Digeec Electronic Clock

Australian Time Equipment Pty Ltd now have available four, six and seven digit electronic clocks in compact plastic cases.

Pictured is the 6-digit which comes in an orange case and is fitted with Sperry planar gas-discharge readouts. 12 or 24-operation is selected by a slide-switch and four push-buttons are provided for time-setting.

Price of the 6-digit model is $61.00 plus sales tax. All enquiries should be directed to Australian Time Equipment Pty Ltd, 192 Pacific Highway, Arncliffe, NSW.

NEW PRODUCTS

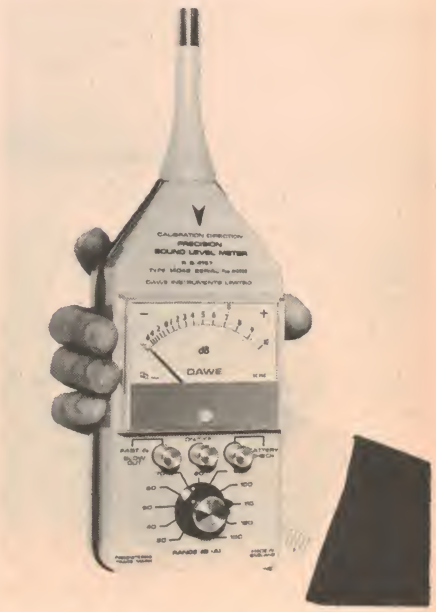
High precision sound level meter

Dawe Instruments Ltd, a leading UK manufacturer of sound level measuring equipment, have recently announced the release of their Precision Sound Level Meter Type 1404B.

Employing fully solid state devices throughout, the new unit consists of a condenser microphone, weighting network, attenuators, high-gain amplifier, and an easily read taut-band meter. The instrument is compact and robust and may easily be held in one hand.

The Type 1404B covers the range 34 to 130 dB (A) and fully complies with B.S. 4197:1967 and IEC Publication 179:1965 for precision sound level meters. This grade of instrument is now called for in many specifications, and is recommended in the Department of Employment's Code of Practice for reducing the exposure of employed persons to noise where the measurement is likely to be used for legal enforcement of a noise limit.

The instrument is powered by a small, inexpensive battery which gives a typical operational life of 80 hours. The complete unit, including the battery, weighs only 1lb 14oz. (0.86 kg) and is provided with a convenient carrying case. An optional Wind Shield Type 1404-1B is available for the microphone to greatly reduce wind noise when taking measurements out of doors.



For further information contact Tecnico Electronics, PO Box 12 Marrickville NSW 2204. Telephone 55-0411.

NEW PRODUCTS

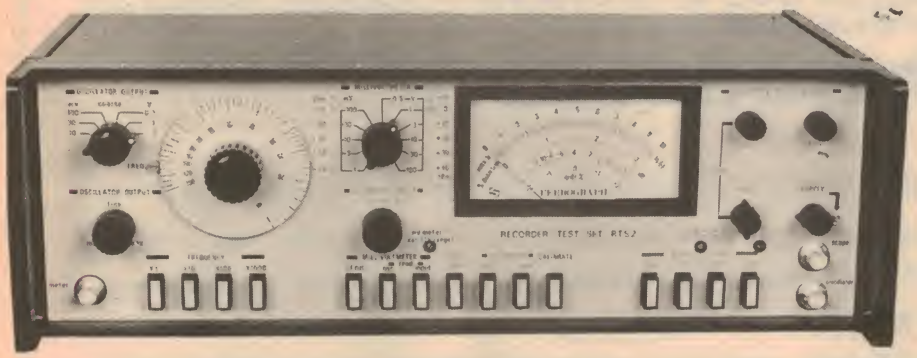
Ferrograph Recorder Test Set

The Ferrograph RTS2 Recorder Test Set is a complete test instrument for measuring the performance of tape recorders. Except for an oscilloscope, nothing extra is required to measure frequency response, harmonic distortion, signal-to-noise ratio, sensitivity, wow and flutter and drift.

Audio measurements generally require a profusion of test equipment all linked together by festoons of cables. A much simpler approach is to use the Ferrograph Recorder Test Set, which together with an oscilloscope will perform all the usual measurements on tape recorders and turntables, and most of the tests on audio amplifiers.

Dimensions of the test set are 441 x 254 x 143mm and weight is 5.9kg. It has a large, easily-read, recessed meter with four scales. There are nine knobs and fifteen pushbuttons.

On the left hand side of the panel is a group of three knobs and four push-buttons. These are for the low distortion audio



oscillator, which covers the range from 15Hz to 150kHz in four ranges. Output is flat within plus or minus 0.2dB over the whole range. Maximum output is 3V with open circuit load, and output impedance is dependent on the setting of the coarse attenuator — but is always less than 450 ohms. Rated distortion is less than 0.025 pc at 1kHz and less than 0.08 pc over the range from 100Hz to 20kHz.

To the right of the audio oscillator controls is the millivoltmeter attenuator. Millivoltmeter sensitivity is from 1mV to 100V FSD in eleven steps of 10dB. Frequency response of the millivoltmeter matches that of the oscillator at plus or minus 0.2dB from 10Hz to 150kHz. Meter indication is RMS values for sinusoidal signals, ie, the meter movement is average indicating. Input impedance is 2 megohms and AC coupled.

Allied with the millivoltmeter is the distortion meter function, which is controlled with three push-buttons, four knobs and the millivoltmeter attenuator. The distortion measurement is the conventional method whereby the fundamental is rejected by a very sharp tuned filter. The remaining harmonics and noise are then measured by the millivoltmeter and read off as a percentage.

Since most routine harmonic distortion measurements are performed at the mid-frequencies the Ferrograph RTS2 has been designed accordingly. The range of fundamental frequencies at which harmonic distortion measurements can be made has been limited to between 400 to 1100Hz approximately. The bandwidth of the distortion measurement is from 15Hz to 20kHz so that high frequency harmonics above 20kHz do not enter into the readings.

A push-button on the front panel provides a further low-cut filter which operates below 400Hz to remove hum and low frequency noise from the measurement. This filter can also be brought into play when making ordinary signal level measurements with the millivoltmeter.

Commenting on the facilities mentioned thus far: **We found the oscillator to be well** within specifications. Distortion, measured both by the Ferrograph and another distortion meter, was below 0.02 pc. Envelope stability was also very good, and the output attenuator accuracy also very satisfactory. A square wave output facility for the oscillator would also be handy when testing amplifiers, but admittedly has less application when testing tape recorders.

Gain of an amplifier or other device is easily measured. First, push the button marked "osc" to read the oscillator level output and then push the button marked "input" to read the output of the device under test. The difference between the two meter readings is the gain or loss of the device under test.

Distortion measurements are also straightforward and easy to make. The null controls are unambiguous in their meter indications and are not too "touchy." We would have preferred to be able to measure distortion over a much wider range of frequencies, which is desirable when assessing amplifier performance, but for tape recorders, the facility is probably more than adequate for determining mid-band distortion and for establishing the 2 or 3 pc distortion levels from which signal-to-noise ratio can be reckoned.

As well as providing meter indication, the metering circuitry provides an output signal which can be connected to an oscilloscope, wave analyser or other device. The output is approximately 1 volt RMS for full-scale indication of the meter and output impedance is approximately 500 ohms.

An interesting point about the millivoltmeter-cum-distortion meter is that the input impedance for the millivoltmeter is 2 megohms while for the distortion function it becomes 100k.

Wow, flutter and drift measurements are performed at a frequency of approximately 3kHz. The RTS2 has an internal fixed oscillator, separate from the widerange oscillator, and which runs at 3kHz. The signal is coupled to the oscillator output terminal when the appropriate push-buttons are pressed, so that it can be recorded on to tape for the wow and flutter measurement. Drift, another measurement allied to the wow and flutter facility, is a measure of the frequency deviation or the speed accuracy of the recorder.

Wow and flutter of turntables can also be measured provided the signal output is greater than 75mV and provided the frequency of the test record can be brought within the plus or minus 5 pc of the nominal 3kHz test frequency of the RTS2. The input impedance of the test set for this function is 50k which means that the signal output from a ceramic cartridge can be used directly. That from magnetic cartridges would have to be fed via a suitable preamplifier.

Wow and flutter signals from the meter circuitry may again be observed on an oscilloscope so that the nature of speed variations can be analysed.

One disadvantage of the RTS2 test set is that all inputs and outputs are unbalanced, ie, one side is connected to earth. This can be a problem with potential "earth loops" complicating the measurements. However, the manufacturers have an answer in the RTS Auxiliary Unit, which provides the facility of balanced inputs and outputs.

Mechanically, the Ferrograph RTS2 is well thought out. Inside, there are three large "mother" boards (ie, a board into which other boards are plugged) and four plug-in boards. In addition, there is a power supply board and a switching board. The whole unit has been designed to minimise connecting leads between the various boards. All circuitry uses discrete semiconductors, ie, transistors and diodes.

For these reasons, maintenance should not present any problems. In addition, Ferrograph have a "replacement board service" which can solve problems for those without qualified technicians. This service is also maintained by the Australian distributor.

A worthwhile improvement, we think, would be to screen-print the abbreviated instruction sheet on the top of the case so that the instructions are not "lost". Accessories supplied with the RTS2 are a 40dB in-line attenuator, a frequency response test tape and the service manual.

Summing up, the Ferrograph is a well-thought-out multi purpose test instrument which can perform most of the necessary measurements on tape-recorders, amplifiers, turntables, cartridges and other electronic equipment.

Price is $625.00 plus sales tax where applicable. Further information can be obtained from the Australian distributors of Ferrograph equipment, Leroya Industries Pty Ltd, 266 Hay Street, Subiaco, WA or their interstate offices or branches of Jacoby, Mitchell and Co Pty Ltd. (L.D.S.)

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NEW PRODUCTS

Ferrograph Auxiliary Test Unit

The Ferrograph Auxiliary Test Unit is designed to complement the Ferrograph RTS2 Recorder Test Set, so that together they form a comprehensive test facility for tape recorders and other audio equipment.

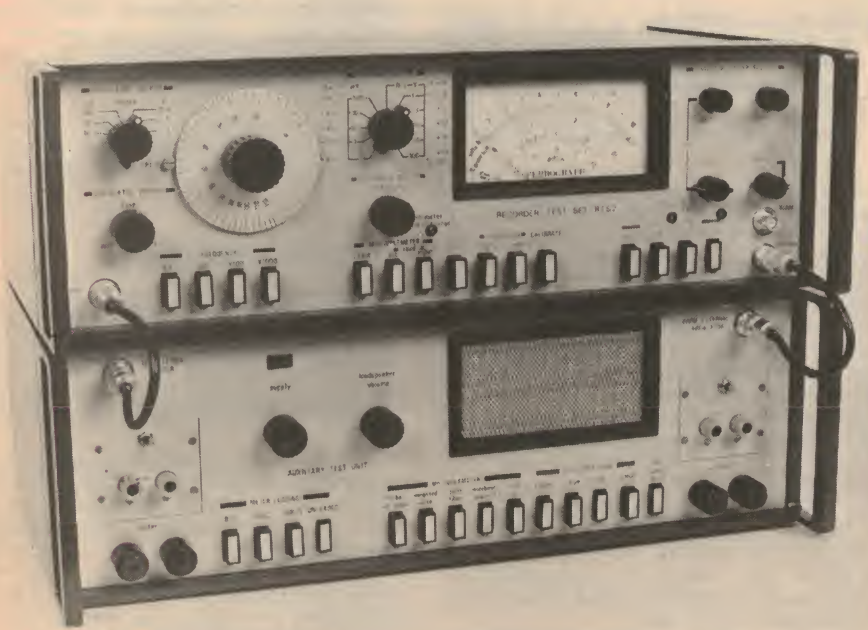
The ATU is styled to match the Recorder Test Set (RTS) and housed in a case with the same dimensions so that they can be stacked together. However, it can be used with virtually any other audio millivoltmeter and/or audio oscillator.

Basically, what the ATU does is to provide the RTS or any other AC millivoltmeter and audio oscillator combination with a choice of balanced or unbalanced inputs for the meter and balanced outputs for the oscillator. In addition, input loading for the meter can be 8 ohms (for audio power measurements), 200 ohms, 600 ohms or unloaded, which results in an input impedance of 50k in the balanced condition or 2M plus 150pF (in shunt) in the unbalanced condition. The balanced termination means that measurements can be made with the test equipment not tied to "earth" except via the unit being measured. This is essential, in many cases, if earth loops are not to complicate the measurements and/or performance.

Input and output connections are made via insulated banana plug sockets which will also take bare wire connections. These connections (meter and oscillator) are duplicated by twin 6.5mm jack sockets on either end of the control panel. The sockets are intended for the tip-ring-sleeve variety of jack. Either one or both of the oscillator output sockets may be selected by a toggle switch so that signals can be connected in any desired fashion to the stereo machine. Similarly, the meter twin sockets can be selected by a toggle switch for measurements on left or right channels.

The jack sockets are mounted on removeable sub-panels, which can be replaced with sub-panels fitted with sockets to suit the user's needs, if necessary.

In addition to providing the variety of input and output termination conditions, the ATU also provides a number of input filters for the meter. For a start, it has one pushbutton for "wideband" noise measurements and this gives a bandwidth of 30Hz to 20kHz. The "weighted" noise button brings a filter into play which attenuates high and low frequencies and gives an order of boost to mid-frequencies to give a result which is closer to the subjective response of the human ear. Three weighting filters are available (on different plug-in boards): NAB, CCIR or DIN 45405. On the review sample the DIN weighting filter was fitted.



On a typical audio amplifier, the DIN weighting filter can give a noise figure lower than the unweighted figure by up to 6dB. The weighting function also makes it somewhat easier to make noise measurements as it chops out large random low-frequency noise pulses. Of course, this can also be achieved by pushing the LF cut button on the RTS unit, but the weighting filter gives a standard test.

The final filter function is a narrow bandwidth 1kHz filter which is used to measure effectiveness of erasure on tape recorders. A sharp 1kHz filter is necessary to eliminate hum and all other irrelevant noise from the measurement. Otherwise, the residual signal left after erasure would be masked by noise. The erasure measurement procedure is to record a 1kHz signal at maximum level, erase it and then measure the residual via the narrow filter.

An amplifier and internal loudspeaker in the ATU permit aural monitoring of the signal being measured by the meter. This is very handy when making frequency response tests as the frequency announcements on the tape or disc need to be identified. It also does away with the need for a separate monitor speaker.

The remaining feature of the ATU to be discussed is the extra attenuator facility for the oscillator, which gives a greater range of signal control. An important feature of the balanced oscillator amplifier in the ATU is that its signal output harmonic distortion is of the order of 0.03 pc which is little worse than that of the oscillator in the Recorder Test Set. Bandwidth of the oscillator amplifier is 30Hz to 20kHz within 0.5dB.

Internal construction follows much the same format as for the companion RTS unit. An interesting feature is that the monitoring amplifier is the Plessey integrated circuit, SL402A.

First impressions of the two test instruments in combination are that there are just too many pushbuttons and other controls, and that it would have been better to build one comprehensive unit. But after a period of use, one finds it easy to drive and flexible in operation.

In conclusion, Ferrograph have provided a good all-round test instrument in the RTS2, at a reasonable price and with the option of a more comprehensive facility, particularly suitable for tape recorders.

Further information can be obtained from the Australian distributors for Ferrograph equipment, Leroya Industries Pty Ltd, 266 Hay Street, Subiaco, WA. (L.D.S.)

BOOKS & LITERATURE

Active filters

ACTIVE FILTERS: Lumped, Distributed, Integrated, Digital and Parametric, by L. P. Huelsman. Published by McGraw-Hill Book Company, New York, 1970. Hard covers, 160 x 235mm, 372pp, many diagrams. Price in Australia $15.30.

To the majority of people experienced in electronics, a filter circuit is made up of a number of capacitors, inductors and resistors and is used to couple signals while shaping them, attenuating and so on. What this book does is to shed light on the new method of obtaining filter circuits, which uses active elements. By using amplifier elements a filter characteristic can be synthesised more easily and more compactly than if the conventional approach was taken using passive filter techniques.

Aimed at the advanced student and the practising engineer, it explains the circuit theory behind active filter design and discusses the geometry and fabrication of integrated circuit filters. A solid background of electric circuit theory is assumed and mathematical derivations are given in brief detail throughout the book.

Listing the chapter headings cummarises the material covered in the book: 1 — Introduction; 2 — Active RC Network Synthesis using Voltage Amplifier; 3 — Gyrator Circuits; 4 — Electronic Circuit Aspects of Active Filters; 5 — Digital Filters; 6 — Parametric Frequency Converters; 7 — Present and Future Trends in Integrated Circuits.

Each chapter is rounded off with a list of references of further material on the particular subject. The writing throughout the book is clear and concise. It must be regarded as an essential text for any designer involved with active RC circuits.

The review copy came from the local office of the publisher and it is available from major technical and university bookstores. (L.D.S.)

Microelectronics

MICROELECTRONICS, by J. R. A. Beale, E. T. Emms, & R. A. Hillbourne. First edition 1971. Published by Taylor Francis Ltd, Cannon House, Macklin St, London WC2. Hard covers, 247 x 165mm, 310 pp, many diagrams and pictures. Price in UK, £5.50.

The authors of this book worked together on the presentation of an extensive lecture tour both in the UK and in Australia, the subject being a forerunner of the information in this book. It was then realised that many thousands of people were interested in this relatively new subject of Microelectronics, its ramifications, the various aspects of manufacture, and the possibilities of the future.

The text of the book is aimed at the undergraduate and skilled technician level while providing information for the graduate as well. The accent is placed on providing a broad background of information, not exhaustively treated nor unnecessarily skimped, but in a fashion to provoke the desire to increase understanding by further reading and study of specialised information.

Beginning with an introductory chapter the book is roughly divided into three sections. Chapters 2-6 deal with the physical basis of microelectronics, treatment of function rather than analytical detail. The reader is thus prepared for a better understanding of the manufacturing processes covered in chapters 7-11. The final chapters are devoted to applications and possibilities of integrated circuits. The treatment is broad and covers the simple and more complex aspects in a general way.

There are 13 chapters, some of the headings being: Semiconductors. The manufacture of integrated slices, Circuit design and Linear circuits. For further reading and reference, a bibliography is included, plus a four page symbol appendix. The book concludes with a four page index.

A well written concisely worded text, up to date and providing much worthwhile information. The book is copiously supplied with clear illustrations and can be recommended to anyone wishing to delve into the subject of microelectronics. (F.J.S.)

More on filters

THEORY AND DESIGN OF ACTIVE RC CIRCUITS, by L. P. Huelsman. Published by McGraw-Hill Book Company, New Yoirk, 1968. Hard covers, 160 x 235mm, 297pp, many diagrams. Price in Australia, $14.40.

Although published six years ago, this book is now more useful than ever. With the ever-increasing availability of economy operational amplifiers and integrated active filters, the book is an essential reference for modern circuit design.

As the name implies, an Active RC circuit is one comprising resistors, capacitors and one or more active devices but no inductances. It is possible to synthesise any RLC filter function with an active RC circuit. This fact has become extremely important over the past few years. Not only does it avoid the cost, weight and nonlinerarity of inductors, but it can be applied to integrated circuit technology which does not allow the use of inductors

Listing the various chapters would not indicate the material covered. Suffice to say that the book is aimed at engineers with a solid background of electronics and electrical circuit theory. As such, it is a very handy text, as noted above.

Our review copy came from the local office of the publisher and it is available via major technical and university bookstores. (L.D.S.)

Data handbook

ELECTRONICS DATA HANDBOOK, by Martin Clifford. Second edition 1972, published by Tab Books, Blue Ridge Summit, Pa, USA. No 118 of a series. Soft covers, 215 x 138 mm, many formulae and diagrams. Suggested price in Australia $6.15.

Everyone in the electronics business has a basic fund of knowledge particular to his own activities, which he would like to see in book form. Many attempts have been made to achieve this goal, but all tend to fall short because our requirements vary so widely. This book is another attempt at that problem and a very good one too, but naturally the contents are limited in depth and scope. It does however take the reader from elementary details through to AC theory with a variety of explanatory information.

Several of the chapters deal with solid state devices, antennas and transmission lines, TV and measuring equipment. All these subjects have been dealt with elsewhere at some length, but it is refreshing to have them included in this type of publication. There is the usual chapter dealing with charts, tables and lists of details but some attempt has been made to gather together the more useful and needed type of data.

All this information is written in an easily read style, and could be a useful addition to the workshop bookshelf, for reference or brushing up on that point in doubt.

Our review sample came from the local distributor, Grenville Publishing Co. Copies should be available from all large technical bookstores. (F.J.S.)

Servicing solid state

HOW TO SOLVE SOLID STATE CIRCUIT TROUBLES, by Wayne Lemons. First edition 1972. Published by Tab Books, Blue Ridge Summit, Pa, USA. Soft covers, 137 x 215mm, 304pp, many circuits and diagrams. Suggested price in Australia $7.40.

Beginning with a short recap on transistor theory and operation, the reader is then presented with groups of similar circuitry in each chapter. The chapter begins with a short outline of the circuit function followed by normal and abnormal conditions of operation. Suggestions of faults and methods of correction are then provided.

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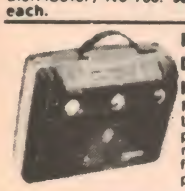

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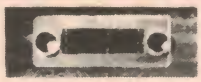

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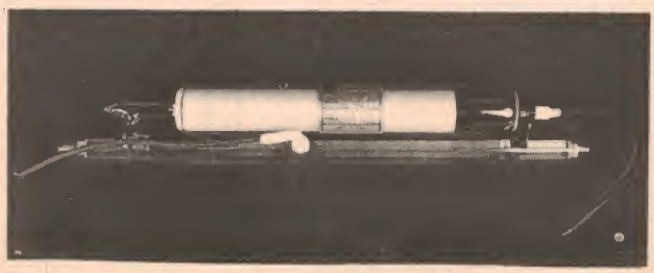

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AMATEUR BAND NEWS & NOTES

by Pierce Healy, VK2APQ

WIA Youth Radio Club Scheme

This month we feature information on the Wireless Institute of Australia Youth Radio Club Scheme, which offers basic training in radio and electronics to those interested in these subjects. There are also some interesting international news items relating to amateur radio.

The widely acclaimed Youth Radio Club Scheme (YRCS), adopted as a Wireless Institute of Australia activity in 1962, is operated on an entirely voluntary basis by a relatively small number of amateur operators, school teachers and others interested in the welfare of the youth in the community. Currently, the number of school students and teenagers wishing to learn about radio and electronics is greater than the instructors or club leaders can handle. This has had a retarding effect on the expansion of the scheme in some areas.

The objects of the scheme are:—

(a) To develop in young people an interest in radio and electronics as a vocation or worthwhile hobby.

(b) To provide students with a hobby which will reinforce their school activities in science and mathematics.

(c) To assist leaders and instructors of youth radio clubs and non-club participants by providing ready made programs of activity.

(d) To co-ordinate the activities of youth radio clubs and non-club participants, and to promote co-operation and exchange of ideas among club leaders.

(e) To co-operate with schools and youth organisations in fostering youth radio clubs.

(f) To give encouragement and recognition to club members and non-club participants who attain certain specified standards of skill.

A series of proficiency certificates has been developed to give a form of recognition to members who develop their knowledge to the standards specified. Certificates are graded at the following levels:—

(I) Elementary, (II) Junior, (III) Intermediate, (IV) Senior, (V) Advanced.

These certificates are awarded in three grades, based on marks in written examinations. From 70 pc to 79 pc is a "Pass Grade", from 80 pc to 89 pc a "Credit Grade", and from 90 pc to 100 pc is "Honours Grade".

For each certificate candidates must construct, to satisfactory standards of workmanship, various pieces of equipment. Many clubs arrange kits to be available at a reasonable cost to members.

"Safety First" is emphasised very strongly from the outset. Projects for the Elementary and Junior Certificates must not be operated from the power mains. Construction of power mains operated equipment for the Intermediate and higher certificates may only be undertaken when written permission has been reveived from the candidate's parents.

The certificates in several of the examination levels are readily accepted by prospective employers, as a positive indication of an applicant's aptitude.

Over a period of years many students have gained positions in the PMG's Department, the Department of Civil Aviation, the Overseas Telecommunication Commission and an increasing number of industrial organisations.

The scheme is organised by a supervisor in each state and the overall project by a federal co-ordinator assisted by a federal secretary.

Further details may be obtained from the following officers:—

Federal Co-ordinator: Reverend R. Guthberlet, 3 Hay Street, Kardina, SA 5554.

Federal Secretary: J. Flynn, 30 Sharp Street, Belmore, NSW 2192.

State Supervisors:

New South Wales: K. Watson, PO Box 59, East Maitland.

Victoria: Reverend Bro F. H. Whittom, St Johns College, 204 Churchill Avenue, Braybrook 3019.

South Australia: A. Dunn, 18 MacKinlay Avenue, Elizabeth Downs, 5113.

Western Australia: N. Hyde, 67 Hennessy Avenue, Orelia, 6167.

Queensland: P. Aldred, 15 Monmouth Street, Morringside 4170.

Tasmania: R. Emmett, PO Box 49, South Launceston, 7250.

Correspondence Section Supervisor: W. Tremewen, 34 Flower Street, Ferntree Gully, Victoria 3156.

Notes on affiliated club activities are published each month in these notes. The official YRCS newsletter is "Zero-Beat", edited and published every two months by A. W. Grove, 6 Truman Avenue, Salisbury East, SA 5109. The subscription rate is 60 cents per year post paid, starting each February.

Commenting on the future for the YRCS, the federal co-ordinator, Rev Bob Guthberlet wrote:

"As we enter another year I would express my thanks to all state supervisors, club leaders and members with my hope that 1974 will mark signal progress in the scheme.

"With the acceptance of novice licensing we are looking forward to receiving the format of this new activity. The syllabus committee under the chairmanship of Rex Black, VK2YA, has been planning our future teaching aids. It is anticipated that their recommendations will be presented to the next conference of YRCS supervisors.

"Regarding the latter, arrangements are in hand to convene at Maitland, NSW towards the middle of 1974.

"Statistical forms were sent to supervisors during November. When they have been compiled we are expecting they will show an increase in membership and activities. To this end, I see the coming year as another step forward in consolidating the aims and ideals of the YRCS. My best wishes to you all, for a happy and fruitful New Year."

QUEENSLAND

A new state supervisor, Phil Aldred, VK4CA, has been co-opted for the YRCS in Queensland. Anyone wanting details of the scheme, or able to assist in the formation of a club, should write to:— P. Aldred VK4CA, 15 Monmouth Street, Morningside 4170, or phone 99-2995.

VICTORIA

The YRCS in Victoria has a new state supervisor, Frank Whittom, VK3BAN, who took over from Ken McLachlan on 1st October, 1973. At present there are approximately 30 member clubs in Victoria, but as the list is incomplete, all member clubs are requested to contact the state supervisor as soon as possible. Clubs who wish to become members may do so by writing to the state supervisor.

St John's College Radio Club

Frank Wittom, VK3BAN, has been club leader of the St John's College Radio Club since 1970. Originally the SJCRC was started by Dr Plummer, who was associated with the introduction of YRCS activities in Victoria.

Apart from Frank, the club has another licensed member, Kevin Baker, VK3BKR. Several members are studying for the AOCP examination.

In 1973, nine members obtained the YRCS-Elementary certificate, ten the Junior certificate, four the Intermediate certificate and two the Senior certificate.

The club station, VK3BSJ is quite active, taking part in the Remembrance Day Contest and the Jamboree-on-the-Air. At present club members should be on a "radio Safari" to Western Australia and will be pleased to make contact with amateurs while operating VK3BSJ mobile during the trip. Operation will be on 3.670MHz, 7.070MHz and 14.160MHz, SSB . The safari was to leave Melbourne on 27th December, 1973 and the itenerary for January was:—

1-1-74 Adelaide to Whyalla via Port Augusta.
2-1-74 Whyalla to Ceduna.
3-1-74 Ceduna to Eucula.
4-1-74 Eucula to Norseman.
5-1-74 Norseman to Albany.
7-1-74 Albany to Perth.
10-1-74 Perth to Geraldton.
12-1-74 Geraldton to Perth
14-1-74 Perth to Norseman
15-1-74 Norseman to Ceduna.
17-1-74 Ceduna to Whyalla via Port Lincoln.
19-1-74 Whyalla to Broken Hill via Port Augusta
21-1-74 Broken Hill to Shepparton via mildura
22-1-74 Shepparton to Melbourne.

During the trip inspections will be made of places of particular interest.

WESTERN AUSTRALIA

There are six schools involved in the YRCS in Western Australia. These are:— Perth Modern School, Churchlands Senior High School, Bunbury Cathedral Grammar School, Hamilton Senior High School, Aquinas College and Wesley College. These schools have produced 91 Elementary level passes, 31 Junior and 8 Intermediate. State supervisor Norm Hyde, VK6NH, says the teachers in all of the above schools have made outstanding efforts.

The Hamilton Senior High School and the Perth Modern School have electronics as an optional subject in the Achievement Certificate, and the Western Australian Board of Secondary Education have accepted the YRCS syllabus as the basis of the course.

Norm Hyde, who took over the supervisor's task in June 1973, says the most disappointing aspect of the past six months has been the larger number of letters from individual students, Scout, Police and citizens groups, who wish to take part in the scheme but cannot obtain help from local amateurs or teachers. However, he foresees that before long a committee will be formed to promote the scheme to those who may be able to assist as club leaders.

Anyone willing to assist is invited to contact: N. Hyde, YRCS Supervisor, 67 Hennessy Avenue, Orelia, WA 6167.

NEW SOUTH WALES

During 1973, Kev Watson, VK2BLW, president of the Maitland Radio Club, took over the task of NSW, YRCS supervisor. Kev prepares a YRCS news sheet for all YRCS clubs in NSW. This news sheet covers club activities and items of general interest and assistance to club leaders and members. The November issue requested all club leaders to forward details of their club's activities in order that the overall progress of the YRCS in 1973 may be recorded. Constructive ideas and comments will be given the fullest attention.

Another point emphasised by Kev is:—

". . . the total membership of your club has nothing to do with the importance of the work you are doing. Even if you have only one member studying for the certificates you are just as important and valuable to the YRCS as any larger group you may know of."

Westlakes Radio Club

Westlakes Radio Club progress during 1973 is reported by club secretary, Eric Brookbank, VK2ZOP.

"The year 1973 will go down as a mile-stone in the progress of the Westlakes Radio Club. After operating under many temporary arrangements for eight years, the club was able to obtain its own premises.

"Over a period of eight months, land was obtained under lease from the local council. Bank finance was obtained, and several members covered the loan. Concentrated publicty was given in the club's 'Monthly Newsletter' and support from many sources was most gratifying.

"The appeal, known as the 'Re-location Fund' was, by the end of 1973, over the $1000 total. The theme used was the catch-phrase 'Just a drop in the bucket'. The most outstanding donation was $500 received from Mr W. S. (Bill) Otty VK2ZL, posibly Australia's oldest licence holder. In November, a building was transported from its original site at Dora Creek and placed on the leased land. Working-bees have made it a centre of activity.

"Class progress during 1973 has not been altogether satisfactory, due to temporary lecture areas, lack of work benches and the absence of some teaching staff. The devoted assistance of lecturers Jamie Campbell, David Crofts and Ian Cameron, who are all high school students, have been the mainstay of the YRCS classes throughout 1973. Attendances were excellent. Beside the adult members there were 48 YRCS members enrolled over the year.

Radio clubs and other organisations, as well as individual amateur operators, are cordially invited to submit news and notes of their activities for inclusion in these columns. Photographs will be published when of sufficient general interest, and where space permits. All material should be sent direct to Pierce Healy at 69 Taylor Street, Bankstown, 2200.

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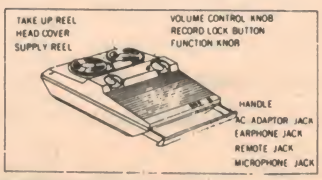

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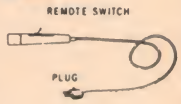

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AMATEUR NOTES

"Members are very keen to get the new club premises occupied and are devoting every spare moment to the task. With materials stored since 1972, workshops, lecture rooms, library, canteen, store and office areas are being set up.

"After a long hard struggle, 1974 should see the Westlakes Radio Club reaping the reward of having premises it can call its own.

"The club has proven its motto — 'Progress through Activity' — the hard way."

Parramatta Marist High School Radio Club

The Parramatta Marist Brothers High School Radio Club was established in 1968 by Rev Bro Cyril, who is still the club leader. The averate roll-call over the past six years has been twenty. The club also has had three members from outside the school.

Certificates gained during 1972 were:— Elementary; 29 honours, 14 credits and 8 passes. Junior; 4 honours, 5 credits, 3 passes. Practical projects ranged from simple to complex, several items providing equipment for the physics laboratory.

The club station, VK2ACQ, was established in 1973, using an AM transmitter donated by Ted Behrmann, VK2ED. The gratitude of the club is also extended to John Lark, VK2OA and Charlie Sims, VK2ABF for their encouragement and guidance.

Maitland Radio Club

Between 70 and 80 persons attend the technical instruction classes each Tuesday and Friday nights when the club is open for general activities.

Classes include two elementary classes for beginners, two junior classes, an intermediate class, an AOCP class for advanced members, two Morse code and two practical work classes.

In addition social evenings and outings are held, and a well appointed club theatrette is available.

Club members take part in local events such as the Maitland show, municipal functions, Royal Newcastle Aero Club's "Aviation Expo 73" and the like.

The club's activities are given excellent publicity in the local newspaper the "Maitland Mercury".

Public figures, including the local members of parliament, the Mayor of the City of Maitland and Inspector of Police give their support to the aims and work of the MRC.

The patrons of the club are Sir Allen Fairhall and Dr R. H. K. McKerihan.

Theatrette and class room equipment has, in the main, been constructed and installed by members. Several donations of equipment have been received, including an emergency lighting unit which was overhauled and installed by members. This allowed club activities to continue during the power restrictions that affected the state.

The committee, headed by Kev Watson, VK2BLW, is planning further extensions and facilities during 1974. Visitors are always welcome. For full details write or telephone the secretary, Allan Watson, PO Box 59, East Maitland, telephone Maitland 37 2282.

WIRELESS INSTITUTE ACTIVITIES

The Victorian division broadcast on 18 November 1973 advised that discussions had taken place between the WIA federal executive, senior officers of the Australian Broadcasting Control Board, and the Radio Branch, PMG's Department. Matters discussed included interference problems likely to be associated with colour TV, and FM broadcasting frequencies.

In the reference to FM broadcasting, the band 420MHz to 450MHz, allocated to amateurs as a secondary service, was discussed. According to the broadcast a suggestion was made that the amateur service be restricted to exclusive use of a small segment of that band.

Arising from the discussions, federal executive requested the formation of a committee to investigate and collate information on amateur activity within that band. This information may be used in further discussions on the amateur status between 420 and 450MHz.

It was emphasised by federal executive that the matters could not be left for discussion and decision at the federal convention in Sydney during Easter 1974.

All divisions of the WIA were asked to consider points raised in federal executive correspondence to federal councillors.

Points of interest relating to amateur use of what is termed the 432MHz band are:—

420MHz to 431.95MHz — amateur television in Australia. The national video carrier frequency is 426.95MHz. 440MHz is also used.

432.05MHz to 432.75MHz — general communication channels using SSB, AM, CW and FM.

435MHz to 438MHz — allocated by the International Telecommunication Union for use by the amateur satellite service.

VICTORIA

Geelong Amateur Radio-TV Club

Notes by Daryl St. John, VK3AQR, in the November issue of the Geelong Amateur Radio & Television Club's "Newsletter", suggest that Geelong is ideally situated for predicting VHF DX openings.

The article "Using TV stations for VHF band openings" summarises observations of propagation effects on signals from TV stations in Adelaide, Central NSW, Wollongong, Queensland, Tasmania and New Zealand.

Observations indicate that VHF DX on both 52MHz and 144MHz is possible when TV signals are received from the areas mentioned.

Helped by this knowledge, a number of DX contacts on those bands have been made from Geelong.

Subscription to the GARC Newsletter is $1.20 per year postage paid.

Full details may be obtained from the Secretary, Geelong Amateur Radio and Television Club, PO Box 520, Geelong, Vic 3220.

Following last month's 144MHz E-M-E report, here is a picture of Chris Skeer, VK5MC who worked W6PO and VE2DFO. Chris first heard his own signal echoes on November 24 1972. His first E-M-E contacts were with W6PO and VE7BQH on March 13 1973. These were bettered by those reported last month.

NEW SOUTH WALES

Central Coast Amateur Radio Club

The Central Coast Amateur Radio Club has released program details for their 17th Annual Field Day, Gosford Showground, Sunday, 24th February 1974.

Those who attended the 1973 field day will recall that the crowd of over 400 had a most enjoyable time. There is plenty of shelter at the showgraound.

The program for 1974 includes something for everyone, with a scramble on HF, 6 metres and 2 metres. Foxhunts, mobile, pedestrian, and talk-in hunts on two and six metres. There will be throwing competitions for the ladies, plus quizzes and special events for the children. A visit to the famous Worrell Reptile Park has also been arranged or visitors may take a bus tour of the area. The usual trade displays will be present and other attractions have been arranged, including the "degassing" of 80's.

Arrangements have been made for visiting amateurs to see over the CCARC rooms and station on the Saturday evening prior to the field day. Local members will be at the station from 7.00pm to entertain visitors. Those who need directions should use the channel 1 repeater to contact a member.

It has been decided that the registration fee for pensioners will be $1.00 upon production of their social security medical card.

Once again, the disposals section will operate. This service has grown so big over the years that the system of lodging items for sale has been re-organised. Those wishing to submit items should write to the secretary, Barry Gibbins, PO Box 238, Gosford, NSW 2250, advising the number of items so that lot numbers can be allotted. Full instructions and lot numbers will be forwarded to the sender.

Note the date in your diary now, 24th February, 1974.

Full program details will be given in next month's notes, or may be obtained by writing to the secretary, CCARC, PO Box 238, Gosford, NSW 2250.

Illawarra Branch

A card has been received from OE6AF of Graz, Austria, stating that he is ready for E-M-E (Moonbounce) tests. Additional information on the equipment OE6AF will use for the tests has been requested.

During the past weeks the antenna dish, supporting steelwork and cubicles have been grit blasted and spray painted by a contractor. Lyle, VK2ALU, comments that it is "A nice shade of jungle green, which is the only colour available in the special protective coating available. At least it blends with the background."

The Illawarra Branch meets on the first Monday of each month at the Wollongong Town Hall Committee Room at 7.30pm. Visitors welcome.

Further details from the secretary, Ian Bowmaker, VK2ZJA, PO Box 110, Dapto, NSW 2530

JOHN MOYLE MEMORIAL FIELD DAY

Amateurs and short-wave listeners throughout Australia are invited to participate in the WIA "John Moyle Memorial National Field Day." This contest has been sponsored by the WIA for more than twenty years. Since 1964 it has been held in the memory of the late John Moyle who did a great amount of work for amateur radio in Australia. John was WIA observer with the Australian government delegation at the International Telecommunication Union Conference in Geneva during 1959.

It is a point of note that John's call sign "VK2JU" has been, at the request of the WIA, withheld by the Radio Branch, PMG's Department, from reissue, as a mark of respect to its holder, whose work is reflected in a number of facets of the amateur service today.

Contestants may participate either as individuals or as part of a group. There are two divisions in this contest. A 24 hour continuous operation division and a 6 hour continuous division, within the 26 hour period set down for the contest.

This year there is a separate section for VHF operators. This was introduced following the interest shown in the 1973 Remembrance Contest rule. Entrants in sections (a), (b), (c) and (d) can operate on VHF bands but cannot enter in section (e).

Portable field stations may contact another portable field station twice provided that 4 hours elapse between contacts.

If there are sufficient entries in section (d), multi-operator, certificates will be awarded to the highest score for an all phone entry as well as the highest open score.

CW-CW contacts will count double.

Date and time:

From 0600 hours GMT, 9th February, 1974, to 0800 hours GMT, 10th February, 1974.

Objects:

The operators of portable field stations or mobile stations within VK call areas will endeavour to contact other portable, mobile or fixed stations in Australian and overseas call areas, on all amateur bands.

Rules:

1 In each division, 24 hour or 6 hour, the operating period must be continuous.

2 In each division there are seven sections:—

AMATEUR NOTES

(a) Portable field stations transmitting phone.
(b) Portable field stations transmitting CW.
(c) Portable field stations transmitting open.
(d) Portable field stations transmitting open, multiple operator.
(e) VHF portable field station or mobile station transmitting.
(f) Fixed (home) transmitting stations.
(g) Receiving of portable and mobile stations.

Contestants must operate within the terms of their licence.

4 A portable field station must operate from a power supply which is independent of a vehicle or permanent installation.
5 No apparatus may be set up on site prior to 24 hours of contest.
6 All amateur bands may be used but cross band operation is not permitted.
7 Cross mode operation is permitted.
8 All operators of a multi-operator station must be located within an 800 metre diameter circle.
9 For each transmitter of a multi-operator station a separate log shall be kept with serial numbers starting from 001 and increasing by one for each successive contact.
10 All mulit-operator station logs should be submitted under one call sign.
11 Only one transmitter of a multi-operator station may be operated on any one band at one time.
12 The exchange of an RS or RST report followed by serial numbers commencing at 001 shall be adopted.
13 Scoring:

Portable field stations and mobile stations with:—

Portable field station or mobile station outside entrant's call area	15 points.
Portable field station or mobile station within entrant's call area	10 points.
Fixed (home) station outside entrant's call area	5 points.
Fixed (home) station within entrant's call area	2 points.

Fixed (home) stations with:—

Portable field station or mobile station outside entrant's call area	15 points.
Portable field station or mobile station within entrants call area	10 points.

14 Portable field stations may contact any other portable field station twice on each band during the period of the contest providing that four hours has elapsed since the previous contact with that station on that band.
15 VHF portable / mobile field stations may contact any other VHF portable mobile field station repeatedly, provided that two hours elapse between contacts on that band.
16 Operation via active repeaters or translators is not acceptable for scoring.
17 All logs shall be set out under headings of: — Date / time in GMT, Band, Emmission, Call sign, RS / T sent, RS / T received, points claimed. List contacts in correct sequence.

There must be a front sheet to show:

Name..... Division.....
Address..... Section.....
..... Call sign.....

Call sign s of other operators....
Location..... Points claimed.....
Equipment used.....Power supply.....
I hereby certify that I / we have operated in accordance with the rules and spirit of the contest.
Signed.....

18 Certificates will be awarded to the highest scorer in each section of the 6 hour and 24 hour divisions. The 6 hour certificate cannot be won by a 24 hour division entrant.
Additional certificates will be awarded for excellent performance.

19 Entrants in sections (a), (b), (c), (d) and (e) must state how power for transmitting was derived.

20 All CW-CW contacts count double.

21 Entries must be forwarded in time to be opened on 22nd March, 1974.
Clearly mark envelope to indicate that it is a John Moyle Memorial National Field Day entry. Address to: Federal Contest Manager, WIA, Box 638, GPO, Brisbane 4001.

Receiving section:

This section is open to all short-wave listeners in VK call areas. The rules shall be the same as for transmitting stations but may omit the serial numbers received.

Logs must show the call sign of the portable or mobile station heard, the serial number sent by it and the call sign of the station being contacted.

Scoring will be on the same basis as for transmitting stations. It will not be sufficient to log a station calling CQ. For scoring purposes the left hand side of the log must have only portable or mobile stations.

A certificate will be awarded to the highest scorer of each of the 6 hour and 24 hour divisions, both individual and club entries. Certificates will be awarded for excellent performance.

AMSAT NEWS

As these notes were being compiled OSCAR 6 had commenced its second year of operation and was nearing the 5000th orbit. Although designed to have a life of one year, indications were that it would continue for some time.

Details of AMSAT-OSCAR B systems (OSCAR 7 after launching) have been circulated by the Radio Amateur Satellite Corporation (AMSAT). The design and construction of these systems is an international effort. Amateurs from four countries — Germany, Australia, Canada and United States have participated.

The nine systems in AMSAT-OSCAR B are:—

1 AMSAT Deutschland Repeater (designed by Karl Meinzer DJ4ZC).
— Input frequency passband between 432.125MHz and 432.175MHz.
— Output frequency passband between 144.975MHz and 145.925MHz.
— Power output (high power mode) is 14 watts PEP.
— Downlink passband is inverted from uplink passband.
— Repeater is 45% efficient using envelope elimination and restoration technique.
— Linear operation — SSB and CW are preferred modes.
— Repeater is commandable to either 3.75 watt or 14 watt PEP output.
— Telemetry beacon at 145.980MHz (200mW).
— Uplink power required 300-400 watts EIRP.

2 AMSAT Two-to-Ten Repeater (designed by Perry Klein, K3JTE).
— Input frequency passband between 145.85MHz and 145.95MHz.
— Output frequency passband between 29.40MHz and 29.50MHz.
— Power output 2 watts PEP.
— Downlink passband is not inverted from uplink passband.
— Linear operation — SSB and CW are preferred modes.
Telementry beacon at 29.50MHz (not the same as OSCAR 6).

3 Morse Code Telemetry Encoder (designed by John Goode, W5CAY).
— 24 analog input channels.
— Converts each analog value into a two-digit Morse Code number or "word".
— A third digit precedes this telemetry value and gives the line number in which the word is located.
— Format is arranged 4 words per line, six lines per telemetry frame.
— Morse Code rate is commandable to 10 words per minute or 20 words per minute.

4 Teletype Telemetry Encoder (developed by Peter Hammer, VK3ZPI and Edwin Scholl, VK3BDS).
— 60 analog input channels.
— Converts each analog channel to a three-digit number transmitted in Baudot code.
— Each three-digit value is preceded by its channel number, making a five-digit telemetry word.
— The data is arranged 10 words per line by six lines per telemetry frame.
— Two lines of status information follow the analog matrix and give the spacecraft time (i.e., time in "counts" from launch, 1 count = 96 minutes.)
— Output keys 435.1MHz beacon in FSK: 850Hz shift; 45.5 baud; (reverse from US standard. Also keys 145.98MHz and 29.50MHz beacons as AFSK, on command.

5 435.1MHz Beacon Transmitter (developed by Larry Kayser, VE3QB and Bob Peper, VE2AO).
— Beacon output frequency is 435.10MHz.
— Power output is 0.4 watts at an efficiency of 45pc.
— Beacon is FSK modulated 850Hz shift.

6 2304MHz Small Beacon Transmitter (developed by San Bernadino Microwave Society, Inc, Corona, California).
— 0.1 watt at 2304MHz.
— Turned on by command only for 30 minute periods.
— CW keyer — "HI" followed by 30 second carrier. Also keyed with Morse code telemetry on command.

7 Codestore — message store-and-forward system (built by John Goode, W5CAY).
— 896 bit memory capacity using COS / MOS shift register memory.
— Loaded via command link.
— Output code speed is 13 words per minute.

8 Experiment Control Logic (developed by Jan King, W3GEY).
— Selects the spacecraft operating modes.
— Protects satellite against excessive battery drain by reducing repeater output power or by shutting it off completely.
— Senses failure or either of the two redundant regulators and switches to opposite regulator automatically.

9 Input Solar power / Battery Charging Regulator (developed by Karl Meinzer, DJ4ZC and Werner Haas, DJ5KQ).
— Converts 6.4 volts at arrays to 14 volts to charge battery or to supply the spacecraft experiments.
— Senses overcharge of battery and reduces charging current.
— Senses failure of either of the two redundant regulators and switches the opposite regulator automatically.

AMSAT encourages the participation of all interested individuals and invites amateurs of all countries to engage in transmissions to the satellites.

Applications for membership should be sent to: Radio Amateur Satellite Corporation, PO Box 27, Washington, D.C. 20044, USA. Membership fee is $5.00 (US) per year.

VHF REPEATERS IN REGION 1

There are at least 202 VHF repeater stations in Region I. Of these 171 are in the 144MHz band (144MHz to 146MHz). The remainder are in the 432MHz band.

The distribution of the 144MHz repeaters in the various countries of the region are:

Austria 9; Belgium 9; Czechoslovakia 2; Denmark 12; Germany 80; Israel 1; Norway 34; Sweden 21; Switzerland 2; England 1.

On 432MHz the distribution is:—

Denmark 1; Germany 34; Switzerland 6.

The region I standard for repeater spacing is 600kHz, the output frequency being the higher. Some German repeaters use 1.6MHz spacing, but these will be phased out by the end of 1974.

German repeaters carry the distinctive call sign DB0, not to be confused with DL0 which indicates a club call sign.

An interesting point is that two installations in Germany may be linked together across 180km of the DDR to provide communication between West Berlin and the Federal Republic.

Access to many of the repeaters is by a tone signal of specified frequency. The frequencies are within the range 1400Hz to 1800Hz.

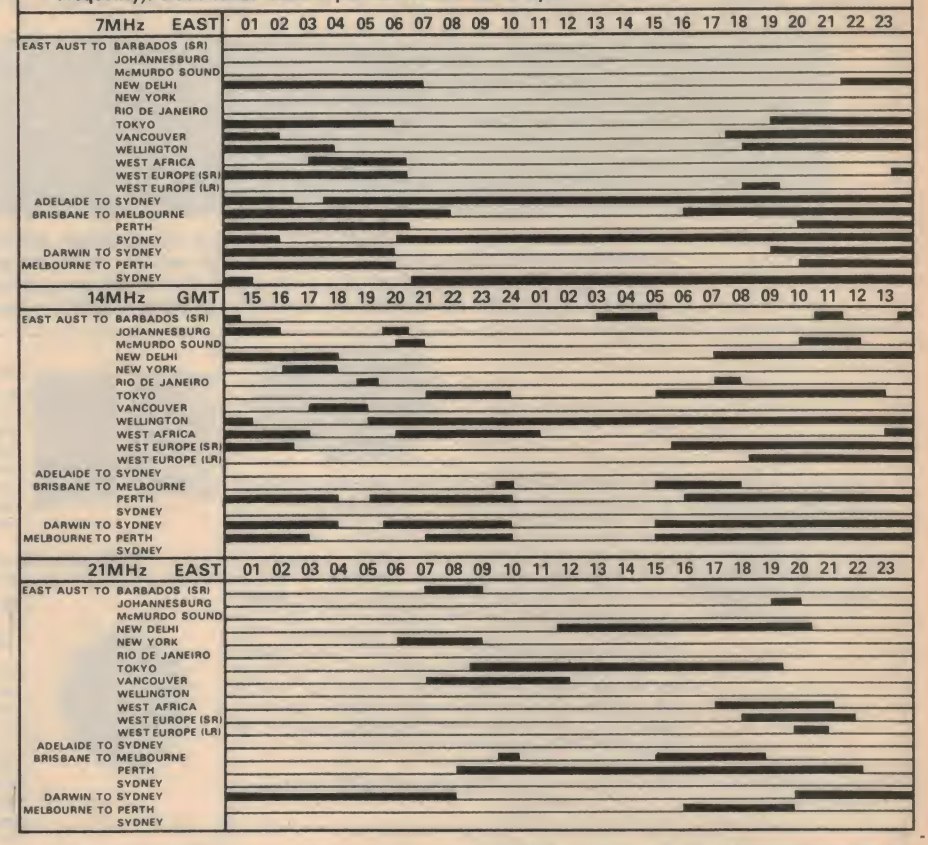
In the case of one of the Swiss 432MHz installations, access is by a 1595Hz tone, after which it may be switched to another 432MHz channel by a 1160Hz tone.

French experiments with UHF VHF repeaters, "Mirabel 1" and "Anjou 3" carried by balloons were very successful. The uplink to the balloon repeaters was on 432MHz with the downlink on 144MHz. There was also telemetry and a beacon on 144MHz. The best DX through "Mirable 1" was between Austria and the Untied Kingdom, a distance of 1100km.

G3JVL heard many stations through "Mirabel 1"; these included 8 French stations, 20 German stations, 1 United Kingdom, 1 from the Netherlands, 2 from Belgium and OE3XUA from Austria.

IONOSPHERIC PREDICTIONS FOR JANUARY

Reproduced below are radio propagation graphs based on information supplied by the Ionospheric Prediction Service Division of the Commonwealth Bureau of Meteorology. The graphs are based on the limits set by the MUF (Maximum Usable Frequency) and the ALF (Absorption Limiting Frequency). Black bands indicate periods when circuit is open. 1.74



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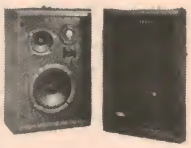
Kit-Sets Australia have imported a range of speaker systems direct from the manufacturers. Never before have such high quality systems been offered at such a low price. The savings have been brought about by our policy of direct importing which brings you, the customer, systems at almost half the normal retail price.

Best Value In Australia

Top of the range is the Model V120 which consists of a roll surround high compliance 12 inch woofer, a 6½ inch midrange (with a crispness which has to be heard to be believed) these two quality speakers are complimented by a highly efficient 1½" dome tweeter with 120° Dispension and the most incredible 2" Super tweeter. Presented in a beautiful walnut finished, sturdy cabinet with a wooden slotted grille, rather than the normal grille cloth fitted to lesser quality units. The cabinet has a cubic capacity of 2.75 cu. ft. having sides 1" thick to stop any resonances that may occur. To top all this the crossover has roll-off of 12db per octave and includes a tone control to allow you to tailor the response to your room. Power handling capacity 50 watts RMS. frequency response 20-2200Hz.

Our Special Direct import price is only **$169** per pair, **$95** per box. Freight **$10** per pair.



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Have you ever tried to find a small extension speaker, small enough to fit anywhere in your room or car having a power handling capacity of 10 watts RMS, a frequency and bass response to equal that of a 10 inch twin cone speaker, with an attractive decorator finish.

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INFORMATION CENTRE

AMPLIFIER DESIGN: Could you please direct me to any source from which I would be able to understand the design procedure of circuits like your Playmaster 132 amplifier and Playmaster 125 power amplifier. I would like to know practically all there is to know about designing such circuits so that I could undertake such a design myself. Also, I am puzzled by the use of a 1.5A transformer in the Playmaster 125 power amplifier. Surely it does not provide enough power to allow the amplifier to deliver 50 watts. (R.T., Fairy Meadow, NSW.)

There is no simple answer to the first part of your letter, unfortunately. The only real solution is to take a course in electronics, such as the four-year Electronics and Communications Certificate or an Electronic Engineering degree course.

The answer to the second part is simple. Assuming 65pc efficiency for the class-B output stage, an input power of 77 watts will be required to allow the amplifier to deliver 50 watts. Actual rating of the transformer is 50VAC at 1.5A which equls 75 watts.

CATHODE RAY VALVES: Thank you for an excellent magazine. My problem is whether a CRT is a valve, or is it classified as some other device like a radiation counter tube? Secondly, can stereo sound be obtained from a mono recording? If not, why is it possible to obtain 4 channel operation from 2 channel discs using a decoder. (W.J., Warragamba, NSW.)

The question whether a CRT is a valve is a debatable one. It has all the elements of a valve, cathode, grid(s) and anode(s) and the complete assembly operates in a vacuum. It is a thermionic device and is catalogued in a separate section of the "valve" department. The vital question seems to be, "does it amplify?"

It is not possible to obtain stereo signals from a mono record, even though four channel sound may be synthesised from a stereo disc. The reason for this is that along with the two obvious signal channels, a stereo disc also contains an effective third channel — basically the difference between the two main channels. With a simple phasing system, one can feed the "ambience" signal present in this channel to rear speakers, to form a three-channel setup. More elaborate ststems are used to produce a pseudo four-channel result.

In even more elaborate systems the four signals are recorded as separate entities, one system using a supersonic carrier on which to impose the two extra signals. A special decoder is then used on replay to extract these two signals and direct them to the appropriate speakers.

For further details, you could refer to our publication "HiFi Stereo Annual."

TRANSISTOR & IC INFORMATION: Can you tell me where I may obtain a book with information on Motorola, RCA, CBS and Fairchild transistors and ICs. Also, could you publish my name and address in the hope that an active licensed radio amateur nearby might help me to pass the PMG's examination. The articles in the magazine are always interesting and good to read. (David Outram, 154 Oriel Road, Ascot, Q.)

For information regarding Motorola devices, we suggest that you contact the Motorola distributors, for RCA devices, RCA and so on. We have published your name and address and it is now up to any amateur who may wish to contact you. We are pleased to know that you appreciate the magazine and the articles.

HOMODYNE TUNERS: I am considering building either the EA Homodyne Tuner or the High Quality AM Broadcast Tuner. However, as FM is coming soon, I wonder if it is worthwhile investing in such a project. The question is, just how easily may AM tuners be converted for receiving FM and would the conversions cause distortion? Also, if conversions to FM are possible, will you be publishing any conversion circuits? (D.T., Lockleys, SA.)

First of all D.T., you must have some inside information regarding the introduction of FM broadcasting in the near future. We do not know of any definite decision along these lines and indeed, the matter is still under investigation. We are of the opinion that it will be several years before we have an

HOW TO USE OUR INFORMATION SERVICES

As a service to readers "Electronics Australia" is able to offer: (1) Project reprints, metal work dyelines, photographs, printed wiring patterns and other filed material to do with constructional projects and (2). A strictly limited degree of assistance by mail or through the columns of the magazine. Details are set out below:

PROJECT REPRINTS: These cost 80c per issue-reprint. Thus, a project spread over three issues will cost $2.40. Reprints are available for all projects, but no material can be supplied additional to that already published. Reprints can be supplied more speedily if they are positively identified and not accompanied by technical queries. Material not on file can normally be supplied in photostat form at 40c per page.

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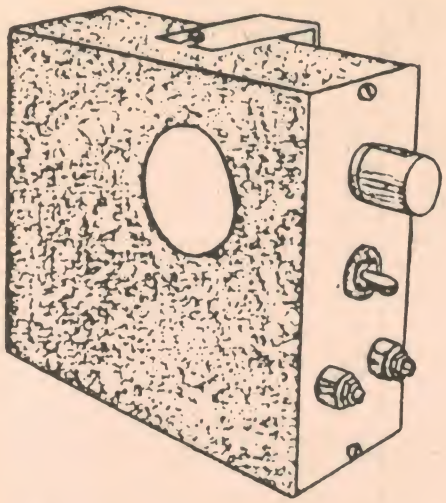
(A)



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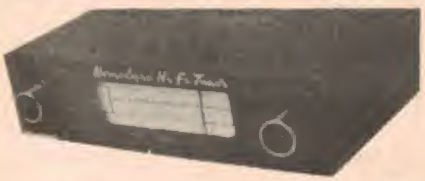

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INFORMATION CENTRE

FM broadcasting service. Although it is often dangerous to generalise, it would probably not be a proposition to even attempt to convert an AM tuner for the reception of FM signals.

In short, we consider that it is still worthwhile to consider building a high quality AM tuner. If and when FM broadcasting does become a reality, we hope to offer suitable designs.

PM 136, BALANCE INDICATORS, etc: I have enjoyed your magazine and built many projects from it for many years, even changing over to solid state with you. I would now like to put in a vote for updating the 1966 3in CRO. Also, could we have an article on "balance indicators"; the best points from which to operate them, best type of meter, etc.

I have just finished a four-channel amplifier using two 136 Amplifiers with 2-4 Adaptor and we are crawling around the floor listening to each speaker trying to get some kind of balance. The best I have done so far is use an audio generator and an output meter, but some records seem to be more heavily recorded on one channel than the other, which means a change of balance is needed. Also, in some cases, I have found separation between channels, through the 2-4 Adaptor, very poor. Is this my layout? (J.D., Ascot Park, SA.)

Thank you for your kind remarks about the magazine J.D., and we are glad to learn you have derived so much pleasure from it. By updating the CRO we assume you mean converting to solid state. We are keeping our eye on this possibility, but we feel that it may not be an economic proposition at the moment.

We have no immediate plans for a balance control. In fact, we are not quite sure what they are supposed to achieve, since the last thing they will indicate from a stereo record is balance. It is seldom that the two signals from any stereo source are at precisely the same level; they simply are not intended to be. You will probably do as well as is necessary with the generator and output meter to ensure that both channels have the same sensitivity, after which it is up to the record.

The 2-4 Adaptor, like similar circuits using the same principle, has to accept certain compromises between left and right separation and back to front separation. It is normal for some records to be better suited to a particular compromise than others.

As you will have seen by now, we have started on a four-channel version of the 136, which will include many features, including both the 2-4 Adaptor and an SQ Decoder, provision for headphones, top cut filters etc.

NOTES & ERRATA

HOMODYNE TUNER: (November 1973, File 2 TU 37): The junction of the leads from DL, D2, C8, C9, L2 and the positive battery lead should be shown connected. (Circuit, page 57).

LSI DIGITAL CLOCK (September and October 1973, 7 CL 12,13): For correct operation of the Seconds readout version, pin 24 of the integrated circuit should be open circuit in the same fashion as pin 11.

Op-amp supply from p55

the heat of the transformer. A tag-strip with screw terminals, or a strip carrying sockets for banana-plugs, is convenient for the output connections. A metal case, earthed through a 3-core flex, is neater and would allow the fitting of the ON-OFF switch Sw1, which otherwise is inconvenient.

Table 1 gives a voltage and current analysis to assist in trouble-shooting. This applies to the Fairchild transistors but should be reasonably accurate for the Motorola types also.

A final caution — DO remember to switch off the power supply unit before doing any work on the circuit which it is supplying!

Homodyne tuner from p65

stations at the low frequency end may be reset by the oscillator coil slug and stations at the high frequency end may be adjusted with the oscillator trimmer. The aerial coil slug and trimmer must also be readjusted following these changes.

Due to the simplicity of this little tuner, the skirt selectivity provided by the tuned circuits is not as good as would be obtained by more elaborate means. This means that some problems may arise in difficult reception areas. Readers should consider this before embarking on the project, unless you wish to do it as an experimental exercise.

One way in which the selectivity may be improved, is to replace the .082uF capacitor shunting the 470 ohm emitter resistor of the IF amplifier with a Murata ceramic filter type BFB-455A. This is a simple two-terminal device and may be fitted as a direct replacement for the capacitor. The terminals will not fit the holes provided for the capacitor, but it may be fitted easily on top or under the board, using tinned copper wire as an extension for one lead.

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P & P A. $1.45, B. $1.60, C. $1.75, D. $1.85.

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Brand new, 3 amp, 240 volt. S.P., S.T. 50c each or 10 for $4.
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Cintel Oscillator and Electronic Counter, type 388. **$250**

SPECIAL lucky dip valve offer, 15 new valves in cartons for only $2.95. We haven't got time to sort them, so you reap the benefit.
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plugs into 240V power and gives both 6V and 12V DC output. 4 amps with hi, medium and low charges.
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¼" x 2400' ON 10½" REELS
$3.95
P & P A. 60c, B. 85c, C. $1, D. $1.10.

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200 MA 24 volt, ½in push movement.
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BARGAIN. Original Quad MK2 amp with pre amp $80. Quad FM Tuner $40 or both $100. Whitfield, 8 Sutton Ave, Seacombe Gardens, SA 5047. Phone 96 1033.

TAPE RECORDER, Stellaphone, older model, 17 x 15 x 7 with sundry tapes. DICTAPHONE, Grundig, Stenorette L with typists equipment. ADDING MACHINE, Contex. Best offer 95-3113.

SPECIALS this month: PM 140 four-channel amp hardware. Case $9 teak cover $10 extra. Brushed aluminium front panel $5. 4 heat sinks $2.60, PC boards $7.80. Post and pack case and / or cover $1, others 15c. Complete kit as above $32 ($22 without TC) post paid. Electronics kit POA. PM 136: Case $7, teak cover $7 extra. PC boards $4.50. Heat sinks $1.30. Hand brushed front panel $2.50. Post and pack as above complete kit $15, post paid. DUNMARK ELECTRONICS & CO, PO Box 72 Booval, Qld 4304.

HEWLETT PACKARD Sig. gen model 614AR Freq. 800-2100MHZ $200. Also coaxial variable attenuators model 394A Freq. range 1 to 2 GHZ. VK6PK, Box 348 Carnarvon 6701.

DERRITRON Radio Tuner, 6 stage AM, Bandspread, powered. Cost $81, almost unused, $20 ONO. Mayner, 37 Esplanade, Torquay, Qld 4657.

SUPER BARGAIN PACKS at incredible prices — **RESISTORS** 5%, 10%, ½W, 1W, ideal for servi ing, VHF, or hobbyist — 100 for $1 (top quality). **POLYESTER CAPS,** top quality 160V, 270V, 400V, 10% tol in a range of values — 100 for $3.50. **POTS:** dual, single, switch and tab pots (no rubbish) — 10 for $2.50. **CERAMIC DISC CAPS** mixed — 50 for. $1 (miniature). **ELECTROLYTIC CAPS** mixed — 25 for $2. **TANTALUM CAPS:** All miniature, mixed — 20 for $2 (no junk). **ZENER DIODES:** Mixed 1W types — 10 for $5. Mixed 10W types — 10 for $8. **SWITCHES:** Including rotary, toggle and push button switches — 10 for $6 (value at least $12) **TAG STRIPS:** Mixed — 50 for $2. **TRIMMERS:** (12-120pF) — 10 for $1. **COILS:** miniature RF, osc, IF coils — 10 for $2. **HURRY! HURRY!** Stocks cannot last. Post and pack 20c or extra for heavy parcels. **MICRONICS,** P.O. Box 175, Randwick, N.S.W., 2031.

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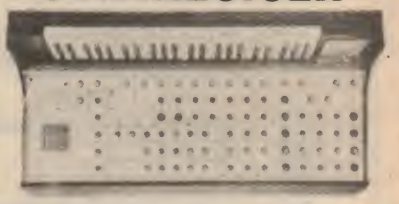

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COMPONENTS: Beyond the needs of our Manufacturing Division. Write to Electronic Consultants & Mfrs, Box 309, Hawthorn, Vic. 3122, for free price list.

ELECTRONICS, back copies from 1964. Ring Ivanfy 666 9841, Ext. 37A.

NEW SUPER BARGAIN SPECIALS FROM MICRONICS!!! BC108 -10 for $2.90, BC109 -10 for $3, BC109C -10 for $4, BC179-55c, AS157 (BC157)-55c, 2N3638A-60c, AC126-55c, AC127-60c, AD161 / 162 Matched Pair — $2.40, 2SB411 (40440)-$1.50 ea, AS205-$1 ea, 2N1305-10 for $4.50, EM402-10 for $1.90. **INTEGRATED CIRCUITS:** Audio amplifiers PA234, 1W RMS audio amp, supply 9 to 22V, output 8, 16 or 22 ohms — only $1.95 (incl. circuit diagram). TAA621, 4W RMS audio amp, supply 9 to 22V output 8 or 16 ohms — only $4.50 (incl. circuit diagram). **ZENER DIODES (ITT):** ZG series (400mW) 1, 2.7, 4.7, 6.2, 10, 15, 18, 27 volts — 35c ea or 10 for $3.20. **ELECTROLYTICS:** Top Quality pigtails, 10uF / 160V, 4uF / 300V, 100uF / 6V — 10 for $1.20, 50uF / 12V, 47uF / 10V — 10 for 70c. Single ended can type 600uF / 65V-50c ea. **POLYESTER CAPS:** Top brand 10%, 160V — .00 .012, .015, .018, .033, .039, .056, .068 — 10 for 50c, .12, .15, .18, .22 — 10 for 70c, .27, .39, .47, .56, .68, .82 — 10 for $1. **CERAMICS:** .001uF, .0027uF (500V), 22pF — 20 for 30c. **COPPER CLAD BOARDS:** (6" x 3") 10 for $1.50. **FERRIC CHLORIDE ETCHANT** (Solid) 100 grm bag — 40c. **TUNING CONDENSERS** (radio) 2 gang-$2, 3 gang-$3. Bank of 2PB switches push on / off — 50c, toggle switches 250v 3A DPST — 50c, slide switches (18 pin) — 50c, micro switches 250v 10A — $1 ea.

WANTED

522 TRANSCEIVER — wanted to correspond with anyone owning one — also remote control assembly wanted to buy. J. Macklin, PO Box 312, Atherton, Qld. 4883.

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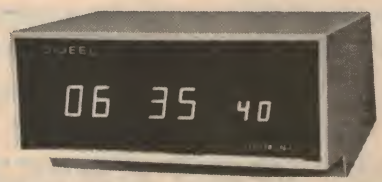

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Please write in block letters with ink or ball-point pen. **Number of insertions** .....

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Index to Advertisers

But reel-to-reel quality is what you'll enjoy from TEAC's new A-450 cassette deck.

We call it the "Challenger." And we challenge you to tell the difference between it and reel-to-reel.

We've perfected our new deck to the point of keeping wow and flutter below 0.07%.

We even improved what you can expect from the Dolby* Noise Reduction System.

Of course, we built the well-known Dolby into our A-450 to eliminate tape hiss and noise.

But we also put the system on the monitoring circuit. So you can copy Dolby cassette tapes and record FM Dolby broadcasts with de-coded monitoring.

Our best cassette deck deserves our best heads. Which is why you get wear-free High Density Ferrite Heads.

And to assure you of the smoothest possible tape travel, we designed a new tape drive mechanism.

Our A-450 is the only cassette deck we know of that even allows for full mic-line mixing capabilities.

Reel-to-reel supremacy has been challenged by the A-450.

Yet over the years, TEAC has continually developed a quality line of cassette decks.

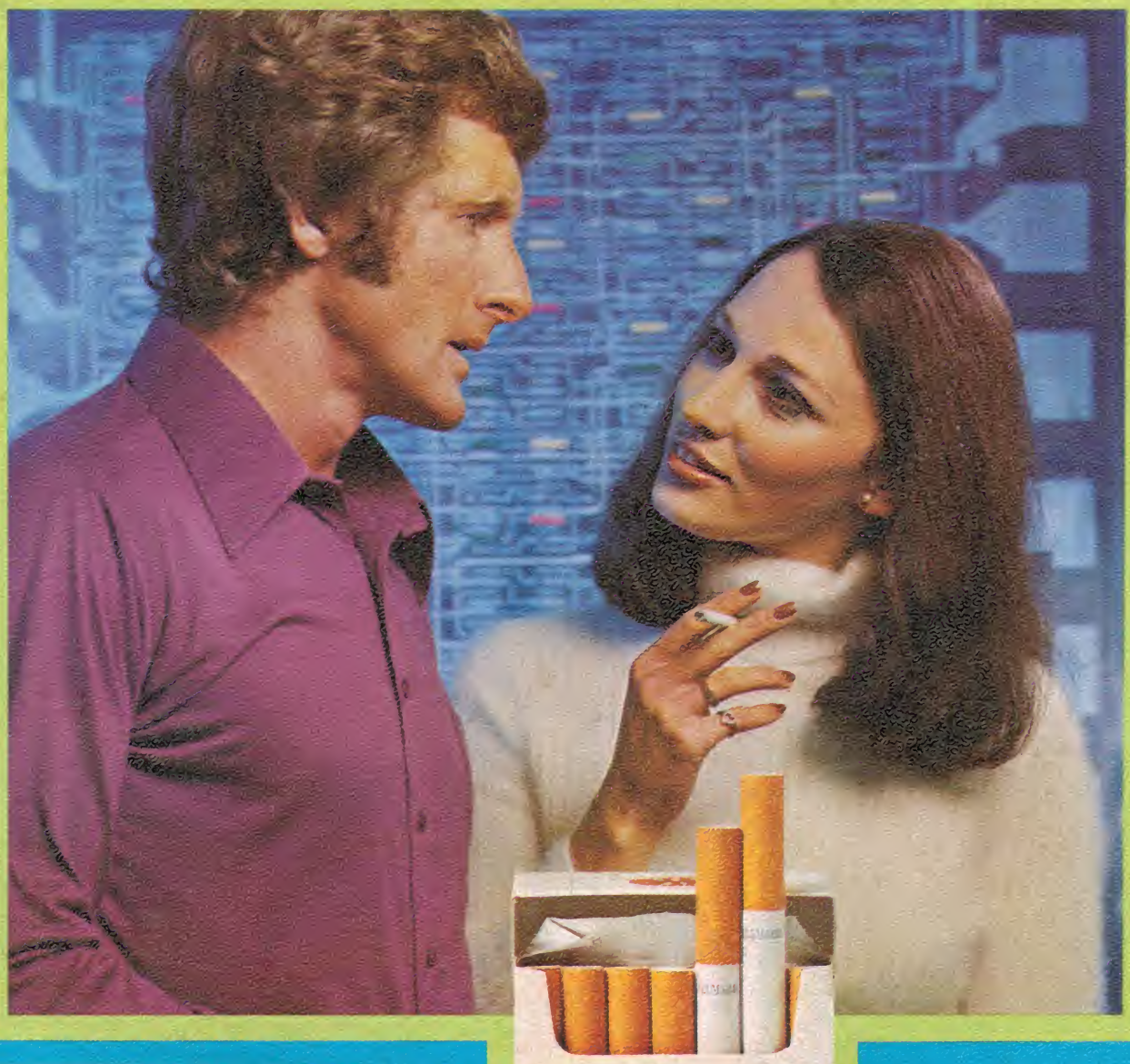
Both our A-350 and A-250 feature the Dolby System. Because even on these decks, we knew that you should hear tapes only one way. Perfectly. They also feature those sophisticated Ferrite Heads.

The A-350 and A-250 are great. But our challenger is the A-450.

Remember. It's a cassette. But if you didn't see it, you'd swear you were listening to a reel-to-reel deck.

TEAC
The sound of perfection

AUSTRALIAN DISTRIBUTORS: Australian Musical Industries P / L, 155 Gladstone St, Sth Melbourne Vic. 3205. Phone: 69-5888 — 619 Pacific H'way, St. Leonards, NSW 2065. Phone: 439 6966 — Arena Distributors, 273 Hay St, East Perth 6000. Phone: 25 9993 — South Aust, Truscott Electronics Pty Ltd, Hindmarsh Square, Adelaide 5000. Phone: 23-3024. **OCEANIC DISTRIBUTORS:** New Zealand: Direct Imports (NZ) Ltd, 590W Southampton Street, Hastings. Phone: 89 184 — Fiji: D. Jeevan & Sons, 87 Cumming Street, (GPO Box 148), Suva. Phone: 22710 — New Guinea: Paul Mow & Co, Box 449, Lae. Phone: 2953.



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